Final

Performance Monitoring Sampling and Analysis Plan Site 18, Former Naval Magazine Waste Storage Area

Naval Station Norfolk Norfolk, Virginia



Prepared for

Department of the Navy Naval Facilities Engineering Command Mid-Atlantic

Contract No. N6247-03-D-0260 Task Order-WE04

October 2008

Prepared by



SAP Worksheet #1—Title and Approval Page (UFP-QAPP Manual Section 2.1)

FINAL

SITE 18- FORMER NAVAL MAGAZINE WASTE STORAGE AREA NAVAL STATION NORFOLK NORFOLK, VIRGINIA

PERFORMANCE MONITORING SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
OCTOBER 2008

Prepared for:
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
MID-ATLANTIC

Prepared by: AGVIQ-CH2M HILL JOINT VENTURE 2

Prepared under:

Contract No. N62467-03-D-0260

Task Order WE04

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Executive Summary

AGVIQ-CH2M HILL Joint Venture 2 (JV 2) has been contracted by the United States (U.S.) Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic Division to implement the removal action documented in the *Final Engineering Evaluation/Cost Analysis* (EE/CA) for Site 18-Former Naval Magazine (NM) Waste Storage Area, Naval Station Norfolk (NSN), Norfolk, Virginia, completed by CH2M HILL in March 2008. The EE/CA was prepared in accordance with current U.S. Environmental Protection Agency (USEPA) and Navy guidance documents for a Non-time Critical Removal Action (NTCRA) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

Chlorinated volatile organic compounds (VOCs) in groundwater are the only Contaminants of potential concern (COPCs) at Site 18. Thus the Removal Action Objective (RAO) is to mitigate potential unacceptable human health risk associated with exposure to chlorinated VOCs in groundwater. The selected treatment for VOCs in groundwater at Site 18 is enhanced reductive dechlorination (ERD). The substrate injection to accelerate dechlorination of site VOCs is detailed in the *NTCRA Work Plan for the Site 18 – Former NM Waste Storage Area, at NSN, Norfolk, Virginia* (JV 2, 2008). The information contained herein provides the details for 1 year of groundwater monitoring subsequent to the substrate injection.

This Sampling and Analysis Plan (SAP) has been completed under contract number N62470-03-D-0260, Task Order (TO) WE04 in accordance with the Navy's Uniform Federal Policy Sampling Analysis Plan (UFP-SAP) policy guidance to ensure that environmental data collected are scientifically sound, of known and documented quality, and suitable for intended uses. The laboratory information cited in this SAP is specific to Empirical Laboratories, LLC in Nashville, Tennessee. Empirical Laboratories was selected based on a competitive selection process and, with the support of Microseeps, Inc. will support all laboratory needs for this project. If additional laboratory services are requested which require modification to the existing SAP, then revised SAP worksheets will be submitted to the Navy and regulatory agencies for approval.

This SAP consists of the 37 worksheets specific to the UFP-SAP. All tables are embedded within the worksheets. All figures are included at the end of the document. The project specific Health and Safety Plan (HSP) is included as **Appendix A**. Field standard operating procedures (SOPs) are included as **Appendix B**, the site-specific laboratory SOPs are included as **Appendix C**, and data management documentation are included as **Appendix D**.

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- 2 ERD Injection and Groundwater Sampling Locations
- 3 Geologic Cross Section A-A'
- 4 ERD Injection Depths

Additional Tables

1 Maximum Concentration and Remedial Goal for Contaminants of Potential Concern

Appendices

- A Health and Safety Plan
- B Field Standard Operating Procedures
- C Laboratory Standard Operating Procedures
- D Data Management Documentation

Abbreviations and Acronyms

BFB 4-bromofluorobenzene bgs below ground surface

CCB continuing calibration blank
CCC calibration check compounds
CCV continuing calibration verification

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act of

1980

CFR Code of Federal Regulations
CLP Contract Laboratory Program

CoC chain of custody

COPC contaminant of potential concern

CORR corrosivity

°C degrees Celsius DCE dichloroethene

DFTPP decafluorotriphenylphosphine

DL detection limit
DO dissolved oxygen
DoD Department of Defense
DCN document control number

ECD electron capture detector

EE/CA Engineering Evaluation/Cost Analysis
EIS Environmental Information Specialist

EOS® Edible Oil Substrate

ERD enhanced reductive dechlorination

FID flame ionization detector

ft feet, foot ft² square feet

FTL Field Team Leader

GC gas chromatograph

GC/MS gas chromatograph/mass spectrometer

H&S health and safety

HAZWOPER Hazardous Waste Operations and Emergency Response

Hg mercury

HSP Health and Safety Plan

IC ion chromotography

ICP inductively coupled plasma ICV initial calibration verification

IDQTF Intergovernmental Data Quality Task Force

IDL instrument detection limit IDW investigation-derived waste

IGN ignitability

IS internal standard

JV 2 AGVIQ-CH2M HILL Joint Venture 2

LC Liquid Chromatography LCS laboratory control sample

LCSD laboratory control sample duplicate

LFB laboratory fortified blank

LIMS Laboratory Information Management Systems

μg/L micrograms per liter

MCL maximum contaminant level
MDL method detection limit
mg/L milligrams per liter

mL milliliter

MRL minimum reporting level

MS/MSD matrix spike/matrix spike duplicate

NAVFAC Naval Facilities Engineering Command

N/A not applicable NC no criteria

NFESC Naval Facilities Engineering Service Center

NIRIS Navy Installation Restoration Information System

NTCRA Non-time-critical Removal Action

NM Naval Magazine
NSN Naval Station Norfolk

ORP oxidation-reduction potential

PAL project action limit

PCB polychlorinated biphenyl

PM Project Manager POC point of contact

PPE personal protective equipment PQL practical quantitation limit PQO project quality objective

PRQL project-required quantitation limit

QA quality assurance

QAO Quality Assurance Officer QAPP Quality Assurance Project Plan

QC quality control QL quantitation limit

RAO removal action objective

RL reporting limit ROI radius of influence RPD relative percent difference RPM Remedial Project Manager RSD relative standard deviation

RT retention time

SAP Sampling and Analysis Plan

SARA Superfund Amendments and Reauthorization Act of 1986

SSC-HW Site Safety Coordinator - Hazardous Waste

SDG sample delivery group SDWA Safe Drinking Water Act SOP standard operating procedure

SPCC system performance check compounds

SVOA semivolatile organic analytes SVOC semivolatile organic compounds

TBD to be determined TCE trichloroethene

TCLP toxicity characteristic leaching procedure

TCLPM toxicity characteristic leaching procedure – metals toxicity characteristic leaching procedure – pesticides

TCLPS toxicity characteristic leaching procedure – semivolatile organic compounds toxicity characteristic leaching procedure – volatile organic compounds

TEAP terminal electron accepting process

TO Task Order

TOC total organic carbon

UFP Uniform Federal Policy

U.S. United States

USEPA United States Environmental Protection Agency

VC vinyl chloride

VDEQ Virginia Department of Environmental Quality

VOC volatile organic compounds

SAP Worksheet #2—SAP Identifying Information

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number: Naval Station Norfolk (NSN)

Site 18 – Former Naval Magazine (NM) Waste Storage Area

Operable Unit: Not Applicable (N/A)

Contractor Name: AGVIQ-CH2M HILL Joint Venture 2 (JV 2)
Contract Number: N62467-03-D-0260, Task Order (TO) WE04

Contract Title: AGVIQ-CH2M HILL JV 2

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the following documents:

Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP) (United States [U.S.] Environmental Protection Agency [USEPA], 2005)

EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS (USEPA, 2002)

2. Identify regulatory program:

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

3. This is a Project-Specific SAP:

This SAP is specific to 1 year of performance groundwater monitoring for a Non-time-critical Removal Action (NTCRA) as detailed in the *Final Engineering Evaluation/Cost Analysis* (*EE/CA*) Site 18 – Former Naval Magazine Waste Storage Area, Naval Station Norfolk, Norfolk, Virginia (CH2M HILL, 2008) and the Non-Time Critical Removal Action Work Plan, Site 18—Former Naval Magazine Waste Storage Area, Naval Station Norfolk, Norfolk, Virginia (JV 2, 2008).

4. List dates of scoping sessions that were held:

Scoping Session
NSN Tier I Partnering Meeting

<u>Date</u> April 16, 2008

5. List dates and titles of any documents written for previous or current site work that are relevant to the current investigation.

<u>Title</u>	<u>Date</u>
Final Site Investigation Summary Report, Site 18—	
Former Naval Magazine Waste Storage Area, Naval	
Station Norfolk, Norfolk Virginia (CH2M HILL, 2007)	November 2007
Final Engineering Evaluation/Cost Analysis (EE/CA)	
Site 18—Former Naval Magazine Waste Storage	
Area, Naval Station Norfolk, Norfolk, Virginia	
(CH2M HILL, 2008)	March 2008
Non-Time Critical Removal Action Work Plan, Site	
18—Former Naval Magazine Waste Storage Area,	
Naval Station Norfolk, Norfolk, Virginia (JV 2, 2008)	June 2008
	June 2008
Naval Station Norfolk, Norfolk, Virginia (JV 2, 2008)	June 2008

- 6. List organizational partners (stakeholders) and connection with lead organization:
 - Virginia Department of Environmental Quality (VDEQ) Regulatory Stakeholder USEPA Region 3 Regulatory Stakeholder
- 7. **Lead organization** (see WS 7 for detailed list of data users):
 - U.S. Department of Navy Lead Agency
- 8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:
 - All SAP Elements required for this project are described herein on the 37 UFP-SAP Worksheets. Therefore, the crosswalk table is not necessary for this project.

SAP Worksheet #3—Distribution List

(UFP-QAPP Manual Section 2.3.1)

Name of SAP Recipients	Title/Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	Document Control Number (DCN) (Optional)
Winoma Johnson, P.E.	Remedial Project Manager (RPM)	Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic	757-444-3418	winoma.johnson@navy.mil	
Steven Hirsh	RPM	USEPA	215-814-3352	hirsh.steven@epa.gov	
Eric Salopek	RPM	VDEQ	804-698-4427	ejsalopek@deq.virginia.gov	
Holly Rosnick	NSN Activity Manager	JV 2	703-376-5230	holly.rosnick@CH2M.com	
Paul Landin	NSN Deputy Activity Manager	JV 2	757-671-6238	paul.landin@CH2M.com	
Adina Carver	Project Manager (PM)	JV 2 (CH2M HILL)	757-671-6213	adina.carver@CH2M.com	
Jason Chebetar	PM	JV 2 (AGVIQ)	757-318-9426	jchebetar@tikigaq.com	
Anita Dodson	Program Chemist	JV 2	757-671-6218	Anita.dodson@ch2m.com	
Megan Hilton	Project Chemist	JV 2	401-619-2657	Megan.hilton@ch2m.com	
Genevieve Moore	Environmental Information Specialist (EIS)	JV 2	757-671-6284	Genevieve.moore@ch2m.com	
To Be Determined (TBD)	Field Team Leader (FTL)	JV 2	to be determined (TBD)	TBD	
TBD	Field Staff	JV 2	TBD	TBD	
Marcia McGinnity	Project Manager (PM)	Empirical Laboratories, LLC	615-345-1115	mmcginnity@empirlabs.com	
Debbie Hallo	PM	Microseeps	412-826-5245	dhallo@microseeps.com	
Nancy Weaver	Senior Chemist	Environmental Data Services, Inc	757-564-0090	nweaver@env-data.com	
Weegie Thompson	Investigation-derived Waste (IDW) Disposal Subcontractor	Potomac Environmental	804-288-5043	wthompson@potomacenv.com	

SAP Worksheet #4—Project Personnel Sign-Off Sheet (UFP-QAPP Manual Section 2.3.2)

Name	Organization/Title/Role	Telephone Number (optional)	Signature/email receipt	SAP Section Reviewed	Date SAP Read
Adina Carver	JV 2 (CH2M HILL) – PM	757-671-6213			
Jason Chebetar	JV 2 (AGVIQ) – PM	757-318-9426			
Paul Favara, P.E.	JV 2 – Project Quality Manager	352-335-2396			
Anita Dodson	JV 2 – Navy Program Chemist	757-671-6218			
Megan Hilton	JV 2 – Project Chemist	401-619-2657			
Genevieve Moore	JV 2 –EIS	757-671-6284			
TBD	JV 2 – FTL	TBD			
TBD	JV 2 – Field Staff	TBD			
Nancy Weaver	Environmental Data Services – Senior Chemist	757-564-0090			
Ruth Welsh	Microseeps, Inc. – Laboratory Manager	412-826-5245			
Betty DeVille	Empirical Laboratories – Inorganic/ Wet Chemistry Lab Manager	615-345-1115			
Tony Monteiro	Empirical Laboratories – Gas Chromatograph/Mass Spectrometer (GC/MS) Lab Manager	615-345-1115			
Jade Holliman	Empirical Laboratories – GC/Liquid Chromatography (LC) Lab Manager	615-345-1115			
Weegie Thompson	Potomac Environmental –IDW disposal subcontractor	804-288-5043			

SAP Worksheet #5—Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1)

Regulatory and Stakeholder Agencies

NAVFAC Mid-Atlantic – Winoma Johnson, P.E. (757-444-3418) USEPA Region 3 – Steven Hirsh (215-814-3352) VDEQ – Eric Salopek (804-698-4427)

Lead Organization

NAVFAC Mid-Atlantic – Winoma Johnson, P.E. (757-444-3418) NAVFAC Atlantic – Sherri Eng (757-322-4366)

Activity Manager

CH2M HILL – Holly Rosnick (703-376-5230)

Deputy Activity Manager

CH2M HILL - Paul Landin (757-671-6238)

Project Managers CH2M HILL – JV 2

Adina Carver (757-671-6213) AGVIQ – JV 2

Jason Chebetar (757-318-9426)

Senior Consultant

Dean Williamson (352-335-2280)

Project Quality Manager

Paul Favara (352-335-52396)

Health and Safety (H&S) Managers

Glen Jackson (757-318-9420 x12) Rich Rathnow (865-560-2908)

Contractor Data Management Project Chemist

Megan Hilton (401-619-2657)

Program Chemist

Anita Dodson (757-671-6218)

EIS

Genevieve Moore (757-671-6284)

Laboratory

Empirical Laboratories, LLC Marcia McGinnity (615-345-115) Microseeps

Debbie Hallo (412-826-5245)

Data Validation

Environmental Data Services, Inc Nancy Weaver (757-564-0090)

IDW

Potomac Environmental Weegie Thompson (804-288-5043)

FTL
TBD
Onsite H&S Officer
TBD

SAP Worksheet #6—Communication Pathways (<u>UFP-QAPP Manual Section 2.4.2</u>)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure (timing, pathway to & from, etc.)
Communication with Navy (lead agency)	RPM	Winoma Johnson	757-444-3418	Point of contact (POC) for the Navy; can delegate communication to other internal or external POCs. RPM will notify USEPA and VDEQ via email within 24 hours for field changes affecting the scope. Navy will have 30 days for SAP review. Post injection data will be presented and discussed during partnering meetings.
Communication with USEPA (regulatory agency)	RPM	Steven Hirsh	215-814-3352	Primary POC for USEPA; can delegate communication to other internal or external POCs. Upon notification of field changes, USEPA will have 24 hours to approve or comment on the field changes. Post injection data will be presented and discussed during partnering meetings.
Communication with VDEQ (regulatory agency)	RPM	Eric Salopek	804-698-4427	Primary POC for VDEQ; can delegate communication to other internal or external POCs. Upon notification of field changes, VDEQ will have 24 hours to approve or comment on the field changes. Post injection data will be presented and discussed during partnering meetings.
Communication regarding overall project status and implementation and primary POC with Navy RPM, USEPA, and VDEQ	Activity Manager	Holly Rosnick	703-376-5230	Forwards information and materials about the project to NAVFAC Mid-Atlantic, USEPA, and VDEQ RPMs. Oversees project and will be informed of project status by the Deputy Activity Manager Paul Landin or PM Adina Carver. Sampling results will be communicated to the project team during partnering meetings.
Communication regarding overall project status and implementation and primary POC with Navy RPM, USEPA, and VDEQ	Deputy Activity Manager	Paul Landin	757-671-6238	Perform the tasks of the Activity Manager when requested by the Activity Manager and/or when the Activity Manager is not available. When performing the roles of the Activity Manager, the Deputy Activity Manager communicates any actions taken to the Activity Manager within 24 hours of the activity.

SAP Worksheet #6—Communication Pathways (cont.) (<u>UFP-QAPP Manual Section 2.4.2</u>)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure (timing, pathway to & from, etc.)
Technical communications for project implementation, and data interpretation	Senior Consultant	Dean Williamson	352-335-2280	The senior consultant is contacted regarding questions/issues encountered in the field and input on data interpretation, as needed. The senior consultant will have 24 hours to respond to technical field questions as necessary. Additionally, the senior consultant will review the data as necessary before partnering team discussion.
Communications regarding project management and implementation of all project phases, and primary POC with Activity Manager and Deputy Activity Manager	JV 2 PM	Adina Carver/ CH2M HILL Jason Chebetar/ AGVIQ	757-671-6213 757-318-9426	All information about the project will be forwarded to the Activity Manager or the Deputy Activity Manager within 24 hours of the activity.
H&S	FTL/Onsite H&S Officer	TBD		Responsible for the adherence of team members to the site safety requirements described in the HSP. Will report H&S incidents and near misses to PM.
Reporting Laboratory Data Quality Issues	Laboratory PM	Marcia McGinnity	615-345-1115	All Quality Assurance/Quality Control (QA/QC) issues with project field samples will be reported within 2 days to the project chemist (Megan Hilton) by the laboratory.
Reporting Data Issues	Data Validation PM	Nancy Weaver	757-564-0090	All issues and discrepancies with laboratory data results will be communicated to the PM and to the laboratory within 2 weeks of receipt of the data.
Data Tracking from collection through upload to database	EIS	Genevieve Moore	757-671-6284	EIS will track data from sample collection through upload to the database ensuring SAP requirements are met by laboratory and field staff. EIS will act as main POC for laboratory QA officer. Laboratory issues will be reported to the PM and project chemist within 4 hours.
Field and analytical corrective actions	FTL/Project Chemist	TBD/ Megan Hilton	TBD/ 401-619- 2657	Any corrective actions for field and analytical issues will be determined by the FTL and/or the Project Chemist and reported to the PM within 4 hours.
Release of Analytical Data	Project Chemist	Megan Hilton	401-619-2657	No analytical data can be released until validation of the data is completed and has been approved by the Project Chemist. The project chemist will review analytical results within 7 days of receipt for release to the project team.
Removal of IDW	JV 2 PM	Adina Carver	757-671-6213	No IDW will be removed from the Site until analytical results have been received, reviewed, and manifests have been approved and signed by the Navy. IDW will be removed within 90 days of generation.

SAP Worksheet #7—Personnel Responsibilities and Qualifications Table (UFP-QAPP Manual Section 2.4.3)

Name	Title/Role	Organizational Affiliation	Responsibilities
Winoma Johnson, P.E.	RPM	NAVFAC Mid-Atlantic	Oversees project
Steven Hirsh	RPM	USEPA	Oversees project
Eric Salopek	RPM	VDEQ	Oversees project
TBD	QA Officer	NAVFAC Atlantic	UFP-SAP QA Officer
Holly Rosnick	Activity Manager	JV 2	Oversees project activities
Paul Landin	Deputy Activity Manager JV 2 Project Delivery Manager	JV 2	Oversees project activities and oversees delivery of JV 2 projects
Adina Carver	PM	JV 2 (CH2M HILL)	Manages project
Jason Chebetar	PM	JV 2 (AGVIQ)	Manages project
Dean Williamson, P.E.	Senior Consultant	JV 2	Provides senior technical support
Paul Favara, P.E.	Senior Consultant	JV 2	Provides UFP-SAP project delivery support
Anita Dodson	Navy Program Chemist	JV 2	Provides UFP-SAP project delivery support and performs data evaluation and QA oversight
Megan Hilton	Project Chemist	JV 2	Assists in SAP preparation, interacts with the laboratory and data validator, and provides QA oversight
Genevieve Moore	EIS	JV 2	Performs data management activities including sample tracking and communication with the laboratory and the data validator
TBD	FTL	JV 2	Coordinates all field activities
Glen Jackson	JV 2 H&S Manager	JV 2	Prepares HSP; manages H&S for all field activities
TBD	H&S Officer	JV 2	Oversees H&S for all field activities
Marcia McGinnity	Laboratory PM	Empirical Laboratories, LLC	Responsible for ensuring proper data tracking and reporting and maintaining communication with project chemist and EIS. Responsible for coordination with Microseeps and for deliverables from Microseeps.
Debbie Hallo	Laboratory PM	Microseeps, Inc.	Responsible for maintaining communication with primary laboratory, Empirical. Will ensure data tracking and quality deliverables.
Nancy Weaver	Data Validation Senior Chemist	Environmental Data Services, Inc	Responsible for ensuring data is validated
Weegie Thompson	IDW Disposal Subcontractor	Potomac Environmental	Responsible for manifest, transportation, and disposal of IDW.

SAP Worksheet #8—Special Personnel Training Requirements Table (UFP-QAPP Manual Section 2.4.4)

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates
Site 18 post- injection groundwater sampling and IDW removal	Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour training or 8-hour annual refresher, as appropriate	Registered training organization	Agency and subcontractor specific	FTL, field team members, site safety coordinator; onsite subcontractor; Navy and regulatory agency representatives	Field team members and site safety coordinators from JV 2; onsite subcontractor; onsite visitors from Navy, USEPA, and VDEQ	Personnel files
Site 18 post- injection groundwater sampling and IDW removal	QA Manager	Registered training organization	Subcontractor specific	Onsite QA Manager	QA Manager from JV 2	Personnel files
Site 18 post- injection groundwater sampling and IDW removal	Site Safety Coordinator (SSC-HW)	Registered training organization	Subcontractor specific	Onsite H&S Officer	Onsite H&S Officer from JV 2	Personnel files

SAP Worksheet #9—Project Scoping Session Participants Sheet

(UFP-QAPP Manual Section 2.5.1)

Project Name: Site 18 Performance Monitoring
Projected Date(s) of Sampling: Groundwater

monitoring at 3, 6, 9, and 12 months post-injection **PM:** Adina Carver – JV 2 (CH2M HILL)

PM: Adina Carver – JV 2 (CH2M HILL) Jason Chebetar – JV 2 (AGVIQ) **Site Name:** Site 18 – Former NM Waste Storage Area

Site Location: NSN, Norfolk, Virginia

Date of Session: April 16, 2008

Scoping Session Purpose: Team agreement on sampling and analysis strategy for first year of post-injection

groundwater monitoring

Name	Title	Affiliation	Phone #	Phone # E-mail Address	
Winoma Johnson, P.E.	RPM	NAVFAC Mid-Atlantic	757-444-3418	757-444-3418 winoma.johnson@navy.mil	
Steven Hirsh	RPM	USEPA	215-814-3352	215-814-3352 <u>hirsh.steven@epa.gov</u>	
Eric Salopek	RPM	VDEQ	804-698-4427	ejsalopek@deq.virginia.gov	Regulator
Holly Rosnick	NSN Activity Manager	JV 2	703-376-5230	703-376-5230 holly.rosnick@CH2M.com	
Paul Landin	NSN Deputy Activity Manager	JV 2	757-671-6238 paul.landin@CH2M.com		NSN Deputy Activity Manager

Comments/Decisions: The scoping was held during a NSN partnering meeting. The team was provided with a presentation overview of the Site 18 project, including both the injection process and the follow-up sampling. The presentation was entitled "Summary of Site 18 Nontime Critical Work Plan."

Action Items: None

Consensus Decisions: The team agrees to the monitoring well network, sampling frequency, sample parameters, and on how data will be evaluated for measuring effectiveness of the injection.

SAP Worksheet #10—Problem Definition

(UFP-QAPP Manual Section 2.5.2)

Site Background and Contaminant Release History

NSN is situated on 4,631 acres of land in the northwestern portion of Norfolk, Virginia. NSN is bounded by Willoughby Bay to the north, the confluence of the Elizabeth and James Rivers to the west, and the City of Norfolk to the south and east (Figure 1). Site 18, the Former NM Waste Storage Area, is located in the southeastern corner of NSN near the intersection of Interstate-64 and Interstate-564. Site 18 was used from 1975 to 1979 to store drums containing waste oil, metal plating solutions and sludges, chlorinated organic solvents (e.g., trichloroethene [TCE], 1,1,1-trichloroethane), acids, and/or paint stripping solutions. The storage area was an open, unpaved yard east of the metal storage buildings in the NM Storage Area (Taussig Can Area). Accidental releases of drum contents occurred onsite, and an intentional spill occurred in July 1979. As a result of the July 1979 spill, a pit was excavated and an existing drainage ditch was widened and lengthened to channel the waste oil and contaminated runoff. The liquids were periodically pumped from the pit and transported to a wastewater treatment plant. A one-time landfill permit was obtained in October 1980 from the Virginia Department of Solid Waste to allow the contaminated soil at Site 18 to remain in place. The area was re-graded and seeded to establish a vegetative cover.

Sampling and analysis was completed at the site to identify media of concern and the extent of the constituent concentrations. These investigations concluded groundwater is the only media of concern at the site and the contaminants of potential concern (COPCs) are chlorinated volatile organic compounds (VOCs), specifically TCE; cis-1,2-dichloroethene (cis-1,2-DCE); 1,1-dichloroethene (1,1-DCE); and vinyl chloride (VC). Chlorinated VOCs are present in groundwater as a result of direct releases from past storage and disposal practices. Further transport of VOCs at Site 18 may occur through dissolution, advection, and dispersion, and decrease in VOC concentrations may occur via attenuation.

Site Features

Site 18 is located within a broad open area adjacent to a remnant pine forest (Figure 2). The ground surface at Site 18 is generally level and is covered in grasses and shrubs. The site is bordered by Patrol Road to the southwest, Installation Restoration Site 2 – the NM Slag Pile to the southeast, and a fenced weapons storage area to the northeast. Overland flow of surface water is toward the small manmade ditch north of and adjacent to the site. There are no areas of archaeological or historical importance at the site.

The hydrogeologic unit relevant to this project is the Columbia Aquifer, which is the surficial aquifer. A cross section of the site is provided on Figure 3.

Pertinent site features are:

- The Columbia Aquifer is comprised of fine to coarse-grained sands with minor amounts of silt, gravel layers, and shell hash.
- Depth to water is typically 3.5 to 7 feet (ft) below ground surface (bgs).

- The Columbia Aquifer is approximately 22 ft thick and is underlain by the Yorktown Confining Unit that extends to approximately 35 ft bgs.
- Groundwater flow is north-northeast through the site toward the drainage channel immediately north of the site boundary. North of the site, across the drainage channel, groundwater flows to the southwest toward the channel.
- The hydraulic gradient across the site from MW01S to the MW03 well cluster was less than 0.005 ft/ft in October 2006.
- The chlorinated VOC plume is estimated to be 11,000 square feet (ft²). VOC concentrations are greatest in samples collected from the MW03 well cluster and were detected throughout the depth of the Columbia Aquifer. The greatest VOC concentrations are generally in the shallower portion of the Columbia Aquifer (less than approximately 15 ft bgs) in the vicinity and to the west of the MW03 well cluster, but VOC concentrations are greater in the lower portion of the Columbia Aquifer (greater than approximately 15 ft bgs) to the east of the MW03 well cluster. The greatest detected concentration is 1,900 micrograms per liter (µg/L) of cis-1,2-DCE in MW03S.
- In the monitoring wells with the greatest VOC concentrations, dissolved oxygen (DO) concentrations were less than 0.5 milligram per liter (mg/L), ferrous iron concentrations were greater than 1 mg/L, and nitrate concentrations were less than 1 mg/L. These concentrations are indicative of anaerobic conditions.
- The presence of methane and ethene suggest degradation of parent VOCs and microorganisms capable of degrading chlorinated ethenes were detected in the samples collected for microbial analysis.

Ecological and Human Risk Evaluations

Preliminary ecological and human health risk evaluations were completed in 2002 based on a qualitative assessment using conservative screening values. No unacceptable risk was determined for ecological receptors due to site-related contaminants above background levels. Potential human health risk was identified for potential exposure to groundwater only. Therefore, the removal action objective (RAO) of the NTCRA for Site 18 is to mitigate potential unacceptable human health risk associated with exposure to chlorinated VOCs in groundwater.

While groundwater at Site 18 is not currently nor is it expected to be used as a potable water supply at or in the vicinity of NSN, the clean up criteria for Site 18 groundwater are the Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs). Concentrations in groundwater samples collected in July 2007 were compared to MCLs to establish the COPCs for the site. Maximum concentrations of COPCs detected in July 2007 and their respective clean up levels are provided on **Table 1**.

TABLE 1
Maximum Concentration and Remediation Goal for COPCs
Site 18, Naval Station Norfolk, Norfolk, Virginia

Chemical of Concern	Maximum Concentration (μg/L)	Clean Up Level (µg/L)
1,1-DCE	7J	7
TCE	46	5
VC	680	2
cis-1,2-DCE	1,900	70

J-Reported Value is Estimated

Non-Time Critical Removal Action

As detailed in the NTCRA Work Plan (JV 2, 2008), enhanced reductive dechlorination (ERD) will be implemented by injecting Edible Oil Substrate (EOS®) into the subsurface to reduce VOC concentrations in groundwater. This treatment targets the area within the $10 \,\mu g/L$ total chlorinated VOC isoconcentration contour line. The treatment area and the injection locations are illustrated in **Figure 2**. A schematic of the injection depths is provided as **Figure 4**.

Project Description

This SAP provides the details for groundwater sampling and analysis to evaluate the NTCRA substrate injection. Baseline data, which will be used as a comparison for the effectiveness of the removal action, were collected in July 2007. Post-injection groundwater samples will be collected from six existing monitoring wells (MW03S, MW03C, MW05S, MW08S, MW09S, and MW10S), at 3, 6, 9, and 12 months following the substrate injection. Land use controls will be maintained at the site until the RAO is achieved.

Environmental Questions answered by this Project

1. Was the substrate effectively distributed?

While EOS® concentrations will not be directly measured, total organic carbon (TOC) will serve as a surrogate to represent the relative amount of substrate available. Effective distribution of substrate will be indicated by post-injection TOC concentrations that are greater than baseline TOC concentrations in samples collected from monitoring wells located with in the assumed radius of influence (ROI) of the injection points.

2. Does the substrate continue to provide an effective source of TOC to facilitate ERD?

The post-injection TOC concentrations will be compared to the TOC concentrations from the baseline and previous post-injection sampling rounds to provide an indication of the amount of substrate present at each post-injection sampling event.

3. Was the injection effective?

The effectiveness of the injection is based on the degree to which the substrate was distributed in the aquifer, the establishment of suitable reducing conditions, and the decrease of COPC concentrations. As described above, TOC will be measured as a surrogate for the distribution of substrate in the aquifer. Geochemical and field data will be used to identify the terminal electron accepting process (TEAP) to determine whether reducing

conditions conducive to reductive dechlorination are present. Post-injection COPC concentrations will be compared against data collected from the baseline and previous post-injection rounds to determine if concentrations are decreasing over time. Decreases in parent VOC compounds and increases in daughter VOC compounds and innocuous end products, ethene, ethane, and methane, are expected.

4. Was the substrate application successful in achieving the RAO?

Post-injection COPC concentrations will be compared against their respective MCL to determine if concentrations have decreased to or below the established clean up criteria.

5. How can assessment of the data be optimized to maximize its value for stakeholder decision making?

COPC data will be provided to the stakeholders to show comparison against MCLs and concentrations over time to determine the extent to which clean up goals have been achieved. Geochemical data will be presented to the stakeholders to show whether the substrate continues to provide suitable conditions for degradation of chlorinated VOCs.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements

(UFP-QAPP Manual Section 2.6.1)

• Who will use the data?

Participants from the Tier I Partnering Team (VDEQ, USEPA, Navy, and CH2M HILL) will use the groundwater data to evaluate overall remedy effectiveness with respect to the reduction of VOCs in the treatment area. Other technically focused disciplines within the each organization may use the data as well. Chemists may use the data to evaluate overall data quality with respect to subcontracted laboratories and or changing chemical conditions in the aquifer. Engineers may use the data in designing remedial systems in the future, and geologists may use the data to gain better understanding of aquifer conditions contributing to contaminant fate and transport mechanisms. IDW characterization results will be used by the project team and the receiving facility to determine and ensure proper disposal of IDW in accordance with applicable regulations.

What are the Project Action Limits (PALs)?

Action limits for the COPCs are the clean up levels listed in **Worksheet #10** and **Worksheet #15-1**. The limits for the geochemical parameters are based on optimal conditions for reductive dechlorination. For example, the limits are based on the range of values which may indicate the TEAP or the availability of carbon and energy for continued degradation. The rationale for each of the constituents is detailed in **Worksheet #15-2**. When applicable, optimal concentrations for the geochemistry parameters were based on the conditions that are considered ideal for natural attenuation based on the *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (USEPA, September 1998, EPA/600/R-98/128). The PALs for IDW characterization are provided in **Worksheet #15-3** through **Worksheet #15-10**.

• What will the data be used for?

Data will be used to determine successful distribution of substrate, monitor changing aquifer characteristics, measure overall reduction of COPCs, and support stakeholder decisions for remedy optimization. IDW characterization results will be used to determine and ensure appropriate disposal of IDW.

• What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or offsite laboratory techniques, sampling techniques)?

Worksheet #17 contains detailed information on the types of data needed for this project.

Monitoring well groundwater samples will be collected from six monitoring wells using a peristaltic pump and low-flow sampling protocol. Samples will be analyzed for COPCs, TOC, methane, ethane, ethene, dissolved iron, dissolved manganese, sulfate, sulfide, nitrate, nitrite, alkalinity, and volatile fatty acids. Water quality parameters (pH, DO, oxidation-reduction potential [ORP], turbidity, salinity, specific conductivity, and

temperature) will be recorded in the field using a Horiba U-22. DO and ferrous iron will be field measured using CHEMetrics and HACH field test kits, respectively. At the conclusion of each sampling event, one composite aqueous IDW sample will be collected and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) VOCs, semivolatile organic compounds (SVOCs), pesticides, herbicides, and metals, as well as total sulfide and cyanide, ignitability, and corrosivity as pH.

How "good" do the data need to be in order to support the environmental decision?

All groundwater data will be distributed to a third party validator for data review against method QA/QC criteria and measurement performance criteria listed in this SAP. Level IV package and QC sampling are required. Data will be used to monitor the performance of the injection throughout the first post-injection year and the effectiveness of the removal action 1 year after the injection. Monitoring will need to continue until clean up levels are met. QC data requirements are detailed in Worksheet #20. IDW data will be evaluated by the project chemist to ensure quantitation limits (QLs) are met. Level II package is required. The EIS will compare the data to the action limits to characterize the waste as either hazardous or non-hazardous waste.

How much data should be collected (number of samples for each analytical group, matrix, and concentration)?

Detailed information on how much data will be collected is provided on **Worksheet #17**. The number of QA/QC samples are detailed in **Worksheet #20**.

Groundwater samples will be collected from six performance monitoring wells and analyzed for the COPCs to assess the effectiveness of the substrate in reducing COPC concentrations and to provide an estimation of the remaining concentrations requiring treatment. TOC, methane, ethane, ethene, dissolved iron, dissolved manganese, sulfate, sulfide, nitrate, nitrite, alkalinity, and volatile fatty acids will be analyzed from the same performance monitoring wells. These data will be used to confirm if the substrate injection established and continues to provide aquifer conditions suitable for reductive dechlorination. Water quality parameter measurements (pH, DO, ORP, turbidity, salinity, specific conductivity and temperature) will be collected to verify the groundwater in the monitoring well has stabilized before sample collection. Temperature and pH, are also evaluated to ensure they remain within the limits tolerated by the microorganisms responsible for the reductive dechlorination. Field sampled ferrous iron and DO and the water quality parameters DO and ORP also provide data for determining if the aquifer conditions are suitable for reductive dechlorination.

Where, when, and how should the data be collected/generated?

Detailed information on where, when, and how the data will be collected is provided in **Worksheet #14**. Groundwater samples will be collected from six monitoring wells (**Figure 2**) at 3, 6, 9, and 12 months following injection of substrate. The sampling scheme is presented on **Worksheet #18**. Monitoring wells MW03S, MW03C, MW09S, and MW10S are located within the treatment area. Analytical results from these wells will be used to determine if the substrate was adequately distributed, if the substrate

continues to remain effective, and if COPC concentrations are decreasing. Monitoring wells MW05S and MW08S are located upgradient and downgradient of the groundwater plume, respectively. Based on previous groundwater sampling data, there are no exceedances of clean up criteria in MW05S and MW08S; accordingly these monitoring wells were selected as boundary wells.

Who will collect and generate the data? How will the data be reported?

JV 2 will collect the groundwater and IDW samples. Analytical data will be generated by Empirical Laboratories, LLC. The groundwater data will then be presented to the stakeholders via technical memorandums completed subsequent to each post-injection monitoring event to summarize results and provide recommendations as appropriate. The IDW data will be presented to the Navy and the receiving facility to determine and ensure appropriate disposal of IDW.

• How will the data be archived?

The data will be loaded to the Navy Installation Restoration Information System (NIRIS) data base. Hardcopy data will be released to the Navy following completion of the project.

• List the project quality objectives (PQOs) in the form of if/then qualitative and quantitative statements.

If after 1 year of performance monitoring, aquifer conditions indicate the substrate is not reducing COPC concentrations in groundwater, the Navy, USEPA, and VDEQ will evaluate current site conditions and assess remedy optimization options.

If after 1 year of performance monitoring, aquifer conditions indicate the substrate has reduced COPC concentrations in groundwater, but is no longer providing the conditions necessary to continue ERD, the Navy, USEPA, and VDEQ will assess remedy optimization options, such as a subsequent injection.

If after 1 year of performance monitoring, aquifer conditions indicate the substrate has reduced COPC concentrations in groundwater, and is providing the conditions necessary to continue ERD, a groundwater monitoring program will be established.

If after 1 year of performance monitoring, aquifer conditions indicate the substrate has reduced COPC concentrations in groundwater to below the project action limits, a sampling strategy will be developed. The sampling strategy will document the analytical parameters and the number of additional sampling events required to verify COPC concentrations have effectively been reduced and no further action is needed for the site.

SAP Worksheet #12-1—Measurement Performance Criteria Table

The laboratory's performance criteria for LCS, Matrix Spike, and Duplicates are adequate to meet the Data Quality Indicators for this project.

Matrix: Groundwater

Analytical Group: VOCs (TCE, cis-1,2-DCE, 1,1-DCE, VC)

Concentration Level: Low

	Analytical	_		Measurement	QC Sample Assesses Error for Sampling (S), Analytical (A), or both
QC Sample	Group	Frequency	Data Quality Indicators	Performance Criteria	(S&A)
Method Blank		Once per 12 hours	Targets < ½ reporting limit (RL)	Bias/ Contamination	A
Trip Blank		Per sample cooler	Targets < ½ RL	Bias/ Contamination	S&A
Laboratory Control Sample (LCS)		Once per 12 hours	% Recovery: TCE: 70-125% Cis-1,2-DCE: 70-125% 1,1-DCE: 70-130% VC: 50-145%	Accuracy/ Bias	A
Surrogate Standards		Added per sample, standard, blank	Control limits: 1,2-Dichloroethane-d4: 70-120% 4-Bromofluorobenzene: 75-120% Dibromofluoromethane: 85-115% Toluene-d8: 85-120%	Accuracy/ Bias	А
Internal Standards	VOCs	Added per sample	Retention time (RT) ±30 seconds; EICP area within - 50% to + 100% of last continuing calibration verification (CCV) (12 hours) for each internal standard (IS).	Accuracy/ Bias/ Precision	A
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)		One per batch of 20	% Recovery: TCE: 70-125% Cis-1,2-DCE: 70-125% 1,1-DCE: 70-130% VC: 50-145%	Accuracy/ Bias/ Precision	А
Field Duplicates]	One per 10 field samples	Values > 5x RL: <u>+</u> 50%	Precision	S&A
Equipment Rinseate Blanks, Field Blanks		One per day of sampling, one per week of sampling	Targets < ½ RL	Bias/ Contamination	S&A

SAP Worksheet #12-2—Measurement Performance Criteria Table

Matrix: Groundwater

Analytical Group: Wet Chemistry: Methane, Ethane, Ethene

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Method Blank		One per batch	Bias /Contamination	Targets < ½ RL	А
Field Duplicate		One per 10 field samples	Precision	Relative percent difference (RPD) ≤ 30%	S&A
Equipment Rinseate Blanks, Field Blanks, Trip Blanks	Wet Chemistry	One per day of sampling, one per week of sampling, one per cooler sent to laboratory	Bias/ Contamination	Targets < ½ RL	S&A
LCS		One per batch	Accuracy/Bias	75-125% for Methane, Ethane, Ethene	А
MS/MSD		One per batch	Accuracy/Bias	75-125% for Methane, Ethane, Ethene	А

SAP Worksheet #12-3—Measurement Performance Criteria Table

Matrix: Groundwater

Analytical Group: Wet Chemistry (Nitrate, Nitrite, Sulfate)

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Reagent Blank		One per batch	Bias/Contamination	Targets < ½ RL	Α
Lab Fortified Blank		One per batch	Accuracy/Bias	Minimum reporting level (MRL) to 10x MRL 75-125%; 10x MRL to highest Cal level 85-115%	А
Instrument Performance Check	Wet	At the beginning and end of the sequence and every ten samples	Accuracy/Bias	Responses Within ± 10%	А
Lab Fortified Sample Matrix	Chemistry	10% of field samples	Accuracy/Bias	Recovery 80-120%	А
Equipment Rinseate Blanks, Field Blanks		One per day of sampling, one per week of sampling	Bias/ Contamination	Targets < ½ RL	S&A
Field or lab duplicate		10% of field samples	Precision	MRL to 10x MRL ±20%; 10x MRL to highest Cal level ±10%	S&A/ A

SAP Worksheet #12-4—Measurement Performance Criteria Table

Matrix: Groundwater

Analytical Group: Wet Chemistry (Sulfide)

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Method Blank		One per batch	Bias/Contamination	Targets < ½ RL	А
Equipment Rinseate Blanks, Field Blanks	Wet	One per day of sampling, one per week of sampling	Bias/ Contamination	Targets < ½ RL	S&A
LCS	Chemistry	One per batch	Accuracy/Bias	Recovery 80-120%	А
Field Duplicate		One per 10 field samples	Precision	RPD ≤ 30%	S&A
Lab Duplicate		One per batch	Precision	RPD <20%	А

SAP Worksheet #12-5—Measurement Performance Criteria Table

Matrix: Groundwater

Analytical Group: Wet Chemistry (Alkalinity)

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Method Blank		One per batch	Bias /Contamination	Targets < ½ RL	А
Field Duplicate		One per 10 field samples	Precision	RPD ≤ 30%	S&A
Equipment Rinseate Blanks, Field Blanks	Wet Chemistry	One per day of sampling, one per week of sampling	Bias/ Contamination	Targets < ½ RL	S&A
LCS		One per batch	Accuracy/Bias	Result between 80-120%	А

SAP Worksheet #12-6—Measurement Performance Criteria Table

Matrix: Groundwater

Analytical Group: Wet Chemistry (Volatile Fatty Acids)

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Continuing Calibration Blank (CCB)		Beginning and end of analytical batch	Bias/Contamination	Targets < ½ RL	А
Field Duplicate	Wet	One per 10 field samples	Precision	RPD ≤ 30%	S&A
Equipment Rinseate Blanks, Field Blanks	Chemistry	One per day of sampling, one per week of sampling	Bias/ Contamination	Targets < ½ RL	S&A
LCS		One per batch of 20	Accuracy/Bias	70-130% recovery	А
MS/ MSD		One per batch of 20	Accuracy/Bias/Precision	70-130% recovery	A

SAP Worksheet #12-7—Measurement Performance Criteria Table

Matrix: Groundwater

Analytical Group: Wet Chemistry (TOC)

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Method Blank		One per Batch	Bias/Contamination	Targets < ½ RL	Α
LCS	Wet Chemistry	One per Batch	Accuracy/Bias	80-120%	Α
Field Duplicate		One per 10 field samples	Precision	RPD ≤ 30%	S&A
Equipment Rinseate Blanks, Field Blanks		One per day of sampling, one per week of sampling	Bias/ Contamination	Targets < ½ RL	S&A
MS/ MSD		One per Batch	Accuracy/Bias/Precision	75-125%	Α

SAP Worksheet #12-8—Measurement Performance Criteria Table

Matrix: Groundwater

Analytical Group: Dissolved Metals (Iron and Manganese)

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Method Blank		One per batch	Bias/Contamination	Targets < ½ RL	Α
LCS		One per batch	Accuracy/Bias	20% of true value	Α
MS		One per batch	Accuracy/Bias	25% of true value if sample < 4x spike added	А
Post-digestion Spike		One per batch, if predigestion matrix spike is out of control limits.	Accuracy/Bias	85-115% of known value. Must be 10-100x the instrument-detection limit (IDL).	А
Field Duplicate		One per 10 field samples	Precision	RPD ≤ 20%	S&A
Equipment Rinseate Blanks, Field Blanks	Metals	One per day of sampling, one per week of sampling	Bias/ Contamination	Targets < ½ RL	S&A
Lab Duplicate		One per batch	Precision	For 6010B values >5xDL, 7470A values > 10 detection limit (DL), RPD<20%	S&A
Inductively Coupled Plasma (ICP) Serial Dilution		As needed	Accuracy/Bias	If original sample result is at least 50x IDL, 5-fold dilution must agree within 10% of original result	А

SAP Worksheet #12-9—Measurement Performance Criteria Table

Matrix: Aqueous IDW

Analytical Group: TCLP-VOCs (TCLPV)

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Method Blank		One per batch	Bias / Contamination	Targets < ½ RL	Α
Surrogate Standards	TCLPV	In each sample and QC analysis	Accuracy / Bias	Must meet acceptance criteria presented in Standard Operating Procedure (SOP)-202.	А
Internal Standards		In each sample and QC analysis	Accuracy / Bias / Precision	Area counts –50% to +100% of initial calibration IS or continuing calibration IS area counts; RTs ±30 seconds of CC	А
MS/ MSD		One set per 20 field samples	Accuracy / Bias / Precision	Must meet acceptance criteria presented in SOP-202.	А
LCS/laboratory control sample duplicate (LCSD)		One per batch of 20 or fewer samples (include LCSD if no MSD in batch)	Accuracy / Bias / Precision	Must meet acceptance criteria presented in SOP-202.	А
Cooler Temperature Indicator		One per cooler	Accuracy / Representativeness	Between 2 and 6 degrees Celsius (°C).	S

SAP Worksheet #12-10—Measurement Performance Criteria Table

Matrix: Aqueous

Analytical Group: TCLP-SVOCs (TCLPS)

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Method Blank		One per batch	Bias / Contamination	Targets < ½ RL	Α
Surrogate Standards	TCLPS	In each sample and QC analysis	Accuracy / Bias	Must meet acceptance criteria presented in SOP-201.	А
Internal Standards		In each sample and QC analysis	Accuracy / Bias / Precision	Area counts –50% to +100% of initial calibration IS or continuing calibration IS area counts; RTs ±30 seconds of CC	А
LCS/ LCSD		One per batch of 20 or fewer samples (include LCSD if no MSD in batch)	Accuracy / Bias / Precision	Must meet acceptance criteria presented in SOP-201	А
MS/ MSD		One set per 20 field samples	Accuracy / Bias / Precision	Must meet acceptance criteria presented in SOP-201	А
Cooler Temperature Indicator		One per cooler	Accuracy / Representativeness	Between 2 and 6°C.	S

SAP Worksheet #12-11—Measurement Performance Criteria Table

Matrix: Aqueous

Analytical Group: TCLP-Pesticides (TCLPP)

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Method Blank		One per batch	Bias / Contamination	Targets < ½ RL	Α
Surrogate Standards		In each sample and QC analysis	Accuracy / Bias	Must meet acceptance criteria presented in SOP-211	А
LCS/ LCSD	TCLPP	One per batch of 20 or fewer samples (include LCSD if no MSD in batch)	Accuracy / Bias / Precision	Must meet acceptance criteria presented in SOP-211	А
MS/ MSD		One set per 20 field samples	Accuracy / Bias / Precision	Must meet acceptance criteria presented in SOP-211	А
Cooler Temperature Indicator		One per cooler	Accuracy / Representativeness	Between 2 and 6°C.	S

SAP Worksheet #12-12—Measurement Performance Criteria Table

Matrix: Aqueous

Analytical Group: TCLP-Herbicides (TCLPH)

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Method Blank		One per batch	Bias / Contamination	Targets < ½ RL	Α
Surrogate Standards		In each sample and QC analysis	Accuracy / Bias	Must meet acceptance criteria presented in SOP-208, 304.	Α
LCS/ LCSD	TCLPH	One per batch of 20 or fewer samples (include LCSD if no MSD in batch)	Accuracy / Bias / Precision	Must meet acceptance criteria presented in SOP-208, 304.	А
MS/ MSD		One set per 20 field samples	Accuracy / Bias / Precision	Must meet acceptance criteria presented in SOP-208, 304.	А
Cooler Temperature Indicator		One per cooler	Accuracy / Representativeness	Between 2 and 6°C.	S

SAP Worksheet #12-13—Measurement Performance Criteria Table

Matrix: Aqueous

Analytical Group: TCLP-Metals (TCLPM)

Concentration Level: Medium (SW-846 1311, 6010B, 7470A)

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Method Blank		One per batch	Bias / Contamination	Targets < ½ RL	A
LCS/ LCSD		One per batch of 20 or fewer samples (include LCSD if no MSD in batch)	Accuracy / Bias / Precision	Must meet acceptance criteria presented in SOP-103, 105.	А
MS		One set per 20 field samples	Accuracy / Bias	Must meet acceptance criteria presented in SOP-103, 105.	А
Post-Digestion Spike	TCLPM	For elements outside of QC limits in matrix spike	Accuracy/Bias	Must meet acceptance criteria presented in SOP-103, 105.	А
ICP Serial Dilution		Per analytical run for ICP	Accuracy/Bias	%Difference 90% - 110%	А
Duplicate		One set per 20 field samples	Precision	RPD <=20%	Α
Cooler Temperature Indicator		One per cooler	Accuracy / Representativeness	Between 2 and 6°C.	S

SAP Worksheet #12-14—Measurement Performance Criteria Table

Matrix: Aqueous

Analytical Group: Total Cyanide Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Method Blank		One per batch	Bias / Contamination	Targets < ½ RL	А
LCS	Total Cyanide	One per batch of 20 or fewer samples	Accuracy / Bias / Precision	%Recovery 0% - 12.4%	A
Cooler Temperature Indicator		One per cooler	Accuracy / Representativeness	Between 2 and 6°C.	S

SAP Worksheet #12-15—Measurement Performance Criteria Table

Matrix: Aqueous

Analytical Group: Total Sulfide
Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Method Blank		One per batch	Bias/Contamination	Targets < ½ RL	Α
Equipment Rinseate Blanks, Field Blanks	Wet	One per day of sampling, one per week of sampling	Bias/ Contamination	Targets < ½ RL	S&A
LCS	Chemistry	One per batch	Accuracy/Bias	Recovery 80-120%	Α
Field Duplicate		One per 10 field samples	Precision	RPD ≤ 30%	S&A
Lab Duplicate		One per batch	Precision	RPD <20%	А

SAP Worksheet #12-16—Measurement Performance Criteria Table

Matrix: Aqueous

Analytical Group: Ignitability (IGN)
Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
LCS		One per batch of 20 or fewer samples	Accuracy / Bias	%Recovery 80% - 120%	А
Duplicate	IGN	One set per 20 field samples, for every sample that flashes, or extinguishes flame <140°C	Precision	RPD <=20%	А
Cooler Temperature Indicator		One per cooler	Accuracy / Representativeness	Between 2 and 6°C.	S

SAP Worksheet #12-17—Measurement Performance Criteria Table

Matrix: Aqueous IDW

Analytical Group: Corrosivity

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
LCS (pH 7.0 buffer)		Every 10 samples	Accuracy / Bias	±0.05 pH units	Α
Duplicate	CORR	One set per 20 field samples	Precision	RPD ≤ 20%	А
Cooler Temperature Indicator		One per cooler	Accuracy / Representativeness	Between 2 and 6°C.	S

SAP Worksheet #13—Secondary Data Criteria and Limitations Table (<u>UFP-QAPP Manual Section 2.7</u>)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
July 2007 Groundwater Sampling	Final EE/CA, Site 18, Former Naval Magazine Waste Storage Area, Naval Station Norfolk, Norfolk, Virginia. CH2M HILL, March 2008.	Following agreement with the Navy, USEPA, and VDEQ, CH2M HILL collected a round of groundwater data from all Site 18 monitoring wells in July 2007.	The data is used in conjunction with the December 2004 data to delineate the horizontal and vertical distribution of the groundwater plume. The data will be used as baseline data to evaluate the effectiveness of the removal action.	Monitoring well screen intervals are 5 to 10 ft in length (Worksheet #18) which limits the certainty in determining the depth of greatest VOC concentrations.
December 2004 Membrane Interface Probe and Grab Groundwater Samples	Final Site Investigation Report, Site 18, Former Naval Magazine Waste Storage Area, Naval Station Norfolk, Norfolk, Virginia. CH2M HILL, November 2007.	Following agreement with the Navy, USEPA, and VDEQ, CH2M HILL completed a membrane interface probe investigation and collected grab groundwater samples from select locations in December 2004.	The data is used in conjunction with the July 2007 data to delineate the horizontal and vertical distribution of the groundwater plume.	VOC concentrations from grab groundwater samples do not directly represent VOC concentrations from monitoring well samples. The data was collected in 2004 and may not be representative of current site conditions.

SAP Worksheet #14—Summary of Project Tasks

(UFP-QAPP Manual Section 2.8.1)

Project Logistics

Work will be performed in Level D personal protective equipment (PPE), which includes safety glasses and safety toed boots. Optional PPE includes the use of Tyvek® coveralls. Upgrades to higher levels of PPE are discussed in the HSP, provided as **Appendix A**.

Project Tasks

Applicable SOPs for project tasks outlined in this section are listed on **Worksheet #21** and provided in **Appendix B**.

• Water Level Survey

Before all groundwater sampling events a complete round of water levels will be recorded from all site monitoring wells sampled (Figure 2). Depth to water and time measured will be recorded in the field logbook.

Equipment Calibration

Daily, and as needed throughout the day, the water quality meter and the air monitoring meter will be calibrated following manufacturer instructions.

Groundwater Monitoring

Groundwater samples will be collected from six monitoring wells at 3, 6, 9, and 12 months following injection. The performance monitoring sampling network is shown on **Figure 2** and the sampling scheme is provided in **Worksheet #18**.

Groundwater samples will be collected using a peristaltic pump following low-flow sampling protocol. All groundwater samples will be collected by placing the sample tubing intake in the middle of the screen interval. Before sample collection, at least one well volume will be purged from each well, during which water quality parameters (pH, DO, ORP, turbidity, salinity, specific conductivity and temperature) will be measured and recorded (approximately every 5 minutes) using a Horiba® U-22 water quality meter. Samples will be collected when water quality parameters have stabilized to within 10 percent for three consecutive readings (Worksheet #22). Water quality parameters, depth to water, approximate sampling depth, and total well depth measurements will be recorded in the field logbook. To collect dissolved iron and dissolved manganese samples groundwater will flow through an in line 0.45 micrometer filter and subsequently into the sample vial. DO measurements will be confirmed using CHEMetrics field test kits and ferrous iron will be measured using a HACH field test kit.

• Equipment Decontamination

All non-disposable sampling equipment will be decontaminated before use and immediately after each use in accordance with applicable SOPs (Appendix B). The water level indicator will be scrubbed with deionized water between each measurement.

IDW Handling

Aqueous IDW generated during groundwater monitoring will be containerized in approved 55-gallon drums, which will be stored at Site 18. Following characterization results for appropriate offsite disposal, aqueous IDW will be removed from the site within 90 days of generation.

Quality Control

Field and laboratory activities will be implemented following SOPs, which are provided in **Appendices B** and **C**, respectively.

QC samples will be collected as outlined on Worksheet #20.

Analytical Tasks

The laboratory will calibrate, maintain, test, and inspect analytical instruments (Worksheets #24 and #25).

The laboratory will process and prepare samples for analysis.

The laboratory will analyze performance samples for various groups of parameters as shown on **Worksheet #18**: Select VOCs, TOC, methane, ethane, ethene, dissolved iron, dissolved manganese, sulfate, sulfide, nitrate, nitrite, alkalinity, and Volatile fatty acids.

The laboratory will analyze aqueous IDW samples by the Toxicity Characteristic Leaching Procedure (TCLP) procedure for VOCs, SVOCs, pesticides, herbicides, metals and also for corrosivity as pH, total cyanide and sulfide, and ignitability.

• Data Management

Appendix D provides guidance and checklists on data management steps such as data recording, data transformation, data reduction, data transfer and transmittal, data analysis, and data review. Procedures for data tracking, storage, archiving, retrieval and security for both electronic and hardcopy data are also provided in **Appendix D**. The Project EIS, Genevieve Moore, is responsible for data tracking and storage. Stacy Davenport will coordinate archiving and retrieval of data.

• Project Assessment/Audit

Project assessment and audits will be completed as detailed on Worksheets #31 and #32.

• Data Review

Data validation will be completed as detailed on Worksheets #35 and #36.

Data usability assessment will be completed as detailed on Worksheet #37.

SAP Worksheet #15-1—Reference Limits and Evaluation Table

Matrix: Groundwater
Analytical Group: VOCs

					Laboratory-specific	
Analyte	CAS Number	Project Action Limit ¹ (μg/L)	Project Action Limit Reference ²	Project QL Goal ³ (μg/L)	QLs (μg/L)	Method Detection Limits (MDLs) (μg/L)
VC	75-01-4	2	MCLs	1	1	0.50
TCE	79-01-6	5	MCLs	1	1	0.33
cis-1,2-DCE	156-59-2	70	MCLs	1	1	0.44
1,1-DCE	75-35-4	7	MCLs	1	1	0.42

¹ Project Action Limits are based upon the most conservative value found for that particular constituent in applicable regulatory criteria.

² Groundwater results will be compared to MCLs.

³ Project QL Goals were determined based on the Laboratory's achievable QLs.

[&]quot;MCLs" are the Federal Maximum Contaminant Levels.

SAP Worksheet #15-2—Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: Various

				Laborato	ory-specific
Analyte	CAS Number	Performance Indicator Level	Effects at this Level	QLs (mg/L)	MDLs (mg/L)
Methane	74-82-8	<0.5 mg/L	VC oxidizes	0.0015	0.0005
Ethane	74-84-0			0.001	0.00033
Ethene	74-85-1	>0.5 mg/L	Ultimate reductive daughter product, VC, accumulates	0.001	0.00033
Nitrate	14797-55-8	<1 mg/L	Reductive pathway possible	0.05	0.017
Nitrite	14797-65-0	Nondetect	Reductive pathway possible	0.25	0.05
Sulfate	14808-79-8	<20 mg/L	At higher concentrations may compete with reductive pathway	0.5	0.17
Sulfide	18496-25-8	>1 mg/L	Reductive pathway possible	1	0.3
Alkalinity	471-34-1	> 50 mg/L	pH is at an optimum level (pH may decrease at concentrations less than 50 mg/L)	1	1
TOC	TOC ¹	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	1	0.5
Iron	7439-89-6	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	0.1	0.03
Manganese	7439-96-5	> initial concentration	Dissolution is occurring in the aquifer	0.015	0.005
Lactic Acid	79-33-4	>0.1 mg/L	Intermediates resulting from biodegradation of	0.1	0.067
Propionic Acid	79-09-4		complex organics; carbon and energy source	0.07	0.052
Butyric Acid	107-92-6			0.07	0.059
Pyruvic Acid	127-17-3			0.07	0.067
Acetic Acid	64-19-7			0.07	0.041

Compounds in Worksheet #15-2 will be used to evaluate aquifer conditions.

¹ Contractor-generated CAS Number

SAP Worksheet #15-3—Reference Limits and Evaluation Table

Matrix: Aqueous IDW

Analytical Group: TCLPV (Volatile results from the leaching procedure)

				Project QL	Lab	oratory-specific
Analyte	CAS Number	Project Action Limit ¹ (μg/L)	Project Action Limit Reference ²	Goal ³ (μg/L)	QLs (μg/L)	MDLs (μg/L)
1,1-DCE	75-35-4	700	40 CFR 261.4	10	10	3.3
1,2-Dichloroethane (1,2-DCA)	107-06-2	500	40 CFR 261.4	10	10	3.3
2-Butanone	78-93-3	200000	40 CFR 261.4	100	100	33
Benzene	71-43-2	500	40 CFR 261.4	10	10	3.3
Carbon tetrachloride	56-23-5	500	40 CFR 261.4	10	10	3.3
Chlorobenzene	108-90-7	100000	40 CFR 261.4	10	10	3.3
Chloroform	67-66-3	6000	40 CFR 261.4	10	10	3.3
Tetrachloroethene	127-18-4	700	40 CFR 261.4	10	10	3.3
TCE	79-01-6	500	40 CFR 261.4	10	10	3.3
VC	75-01-4	200	40 CFR 261.4	10	10	3.3

¹ Project Action Limits are based upon the most conservative value found for that particular constituent in applicable regulatory criteria.

² Groundwater results will be compared to 40 CFR 261.4.

³ Project QL Goals were determined based on the Laboratory's achievable QLs.

[&]quot;40 CFR 261.4" is from the Code of Federal Regulations (CFR), Section 40, Part 261.

SAP Worksheet #15-4—Reference Limits and Evaluation Table

Matrix: Liquid IDW

Analytical Group: TCLPS (Semivolatile results from the leaching procedure)

				Project QL	Lab	oratory-specific
Analyte	CAS Number	Project Action Limit ¹ (μg/L)	Project Action Limit Reference ²	Goal ³ (μg/L)	QLs (μg/L)	MDLs (μg/L)
2-Methylphenol	95-48-7	200000	40 CFR 261.4	50	50	10
4-Methylphenol	106-44-5	200000	40 CFR 261.4	50	50	10
1,4-Dichlorobenzene	106-46-7	7500	40 CFR 261.4	50	50	10
2,4-Dinitrotoluene	121-14-2	130	40 CFR 261.4	50	50	10
Hexachlorobenzene	118-74-1	130	40 CFR 261.4	50	50	10
Hexachlorobutadiene	87-68-3	500	40 CFR 261.4	50	50	10
Hexachloroethane	67-72-1	3000	40 CFR 261.4	50	50	10
Nitrobenzene	98-95-3	2000	40 CFR 261.4	50	50	10
Pentachlorophenol	87-86-5	100000	40 CFR 261.4	200	200	20
Pyridine	110-86-1	5000	40 CFR 261.4	200	200	20
2,4,5-Trichlorophenol	95-95-4	400000	40 CFR 261.4	50	50	10
2,4,6-Trichlorophenol	88-06-2	2000	40 CFR 261.4	50	50	10

¹ Project Action Limits are based upon the most conservative value found for that particular constituent in applicable regulatory criteria.

² Groundwater results will be compared to 40 CFR 261.4.

³ Project QL Goals were determined based on the Laboratory's achievable QLs.

SAP Worksheet #15-5—Reference Limits and Evaluation Table

Matrix: Liquid IDW

Analytical Group: TCLPP (Pesticide results from the leaching procedure)

				Project QL	Lab	oratory-specific
Analyte	CAS Number	Project Action Limit ¹ (µg/L)	Project Action Limit Reference ²	Goal ³ (µg/L)	QLs (µg/L)	MDLs (μg/L)
gamma-BHC (Lindane)	58-89-9	400	40 CFR 261.4	0.1	0.1	0.03
Heptachlor	76-44-8	8	40 CFR 261.4	0.1	0.1	0.03
Heptachlor epoxide	1024-57-3	8	40 CFR 261.4	0.1	0.1	0.03
Endrin	72-20-8	20	40 CFR 261.4	0.1	0.1	0.03
Methoxychlor	72-43-5	10000	40 CFR 261.4	0.1	0.1	0.03
Toxaphene	8001-35-2	500	40 CFR 261.4	10	10	2.0
Chlordane (technical)	12789-03-6	30	40 CFR 261.4	0.5	0.5	0.17

¹ Project Action Limits are based upon the most conservative value found for that particular constituent in applicable regulatory criteria.

² Groundwater results will be compared to 40 CFR 261.4.

³ Project QL Goals were determined based on the Laboratory's achievable QLs.

SAP Worksheet #15-6—Reference Limits and Evaluation Table

Matrix: Liquid IDW

Analytical Group: TCLPH (Herbicide results from the leaching procedure)

				D 1 (0)	Laboratory-specific		
Analyte	CAS Number	Project Action Limit (μg/L) Project Action Limit (μg/L) Project Action Limit Reference ² (μg/L)		Goal ³	QLs (µg/L)	MDLs (µg/L)	
2,4,5-TP (Silvex)	93-72-1	1000	40 CFR 261.4	0.5	0.5	0.2	
2,4-D	94-75-7	10000	40 CFR 261.4	5.0	5.0	2.0	

¹ Project Action Limits are based upon the most conservative value found for that particular constituent in applicable regulatory criteria.

² Groundwater results will be compared to 40 CFR 261.4.

³ Project QL Goals were determined based on the Laboratory's achievable QLs.

SAP Worksheet #15-7—Reference Limits and Evaluation Table

Matrix: Liquid IDW

Analytical Group: TCLPM (Metal results from the leaching procedure)

		<u> </u>		Desired Ol	Laborator	ry-specific
Analyte	CAS Number	Project Action Limit ¹ (μg/L)	Project Action Limit Reference ²	Project QL Goal ³ (µg/L)	QLs (µg/L)	MDLs (µg/L)
Arsenic	7440-38-2	5000	40 CFR 261.4	100	100	30
Barium	7440-39-3	100000	40 CFR 261.4	2000	2000	50
Cadmium	7440-43-9	1000	40 CFR 261.4	50	50	10
Chromium	7440-47-3	5000	40 CFR 261.4	100	100	20
Lead	7439-92-1	5000	40 CFR 261.4	30	30	15
Selenium	7782-49-2	1000	40 CFR 261.4	50	50	30
Silver	7440-22-4	5000	40 CFR 261.4	100	100	10
Mercury	7439-97-6	200	40 CFR 261.4	2.0	2.0	0.8

¹ Project Action Limits are based upon the most conservative value found for that particular constituent in applicable regulatory criteria.

² Groundwater results will be compared to 40 CFR 261.4.

³ Project QL Goals were determined based on the Laboratory's achievable QLs.

SAP Worksheet #15-8— Reference Limits and Evaluation Table

Matrix: Liquid IDW

Analytical Group: Total sulfide and cyanide

Analyte				Danis at Ol	Laboratory-specific		
	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project QL Goal (µg/L)	QLs (µg/L)	MDLs (μg/L)	
Total Cyanide	57-12-5	NC	N/A	0.25	0.25	0.13	
Total Sulfide	18496-25-8	NC	N/A	2.3	2.3	0.75	

SAP Worksheet #15-9—Reference Limits and Evaluation Table

Matrix: Liquid IDW Analytical Group: CORR

				5 1 4 61	Laboratory-specific		
Analyte	CAS Number	Project Action Limit ¹ (µg/L)	Project Action Limit Reference ²	Project QL Goal (µg/L)	QLs (µg/L)	MDLs (μg/L)	
рH	PH ³	2 <ph<12.5< td=""><td>40 CFR 261.4</td><td>0<ph<14< td=""><td>N/A</td><td>N/A</td></ph<14<></td></ph<12.5<>	40 CFR 261.4	0 <ph<14< td=""><td>N/A</td><td>N/A</td></ph<14<>	N/A	N/A	

¹ Project Action Limits are based upon the most conservative value found for that particular constituent in applicable regulatory criteria. ² Groundwater results will be compared to 40 CFR 261.4.

³ Contractor-generated CAS Number

SAP Worksheet #15-10—Reference Limits and Evaluation Table

Matrix: Liquid IDW Analytical Group: IGN

	Project Action Limit ¹				Laboratory-specific	
Analyte	CAS Number	(degrees Fahrenheit [°F])	Project Action Limit Reference ²	Project QL Goal ³ (°F)	QLs (°F)	MDLs (°F)
Ignitability	FLASHPOINT ⁴	140	40 CFR 261.4	140	N/A	N/A

¹ Project Action Limits are based upon the most conservative value found for that particular constituent in applicable regulatory criteria.

² Groundwater results will be compared to 40 CFR 261.4.

³ Project QL Goals were determined based on the Laboratory's achievable QLs.

⁴ Contractor-generated CAS Number.

SAP Worksheet #16—Project Schedule / Timeline Table (<u>UFP-QAPP Manual Section 2.8.2</u>)

		Dates (M	M/DD/YY)		
Activities	Organization	Anticipated Date(s) of Initiation	Anticipated Date of Completion	Deliverable	Deliverable Due Date
3-month post-injection sampling	JV 2	11/17/08 (Sampling)	01/23/09 (Data Loaded)	Technical Memorandum	03/23/09
6-month post-injection sampling	JV 2	02/16/09 (Sampling)	04/20/09 (Data Loaded)	Technical Memorandum	06/22/09
9-month post-injection sampling	JV 2	05/18/09 (Sampling)	07/20/09 (Data Loaded)	Technical Memorandum	09/21/09
12-month post-injection sampling	JV 2	08/17/09 (Sampling)	10/19/09 (Data Loaded)	Technical Memorandum	12/23/09

SAP Worksheet #17—Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

Matrix	Depth of Samples	Analysis	Method	Number of Samples	Rationale	Sampling Strategy	
		Select VOCs (COPCs)	SW846 8260B	6	Evaluate degradation of the chlorinated VOCs and migration of the contaminant plume as a result of groundwater treatment		
		Methane, Ethane, Ethene,	RSK175	6	Evaluate degradation of chlorinated ethenes to innocuous byproducts	See Figure 2 for groundwater	
	тос	SW846 9060	6	Fuglists availability of carbon and anarry source	sampling locations.		
	Volatile Fatty Acids (Acetic, Butyric, Pyruvic, Propionic, Lactic)	AM23G	6	Evaluate availability of carbon and energy source for reductive dechlorination	MW05S is located upgradient of the treatment area to monitor plume migration and serve as a background monitoring well.		
Monitoring Well Groundwater	Middle of well screen	Alkalinity	USEPA310.1	6	Evaluate buffering capacity of system	MW08S is located downgradient of the	
Sample	well screen	DO	CHEMetrics Field Test Kit	6		treatment area to monitor plume migration.	
		Ferrous Iron	HACH Field Test Kit	6		MW03S, MW03C, MW09S, and MW10S are located within the treatment area to monitor performance	
		Nitrate, Nitrite, Sulfate	USEPA300.0	6	Evaluate TEAP	of injections and degradation of COPCs.	
		Sulfide	USEPA 376.1	6		001 03.	
		Dissolved Iron, Dissolved Manganese	SW-846 6010B	6			

Note:

The number of samples is per event. There are four sampling events scheduled at 3, 6, 9, and 12 months post-injection. The associated QA/QC samples for each event are detailed on Worksheet #20.

One composite IDW sample will be collected following each groundwater sampling event.

SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sampling Location / Identification (ID) Number	Matrix	Depth	Well Screen Interval (ft bgs)	Analytical Group	Number of Samples	Sampling SOP Reference
NBS18-MW03C-YYQ			16 - 21			
NBS18-MW03C-YYQ (MS/MSD)			16 - 21			
NBS18-MW03CP-YYQ (duplicate)			16 - 21	Select VOCs, TOC,		See Appendix B
NBS18-MW03S-YYQ	0	undwater Middle of Screen Interval	2.5 – 12.5	methane, ethane, ethene, dissolved iron,	See Worksheet #20	
NBS18-MW05S-YYQ	Groundwater		3.5 – 13.5	dissolved manganese, sulfate, sulfide, nitrate, nitrite, alkalinity, and Volatile fatty acids.		
NBS18-MW08S-YYQ			12.5 – 17.5			
NBS18-MW09S-YYQ			7.5 – 12.5			
NBS18-MW10S-YYQ			17 - 22			
NBS18-IWMMDDYY	Aqueous	composite from drum	NA	TCLP-VOCs, SVOCs, Pesticides, Herbicides, Metals, Ignitability, Corrosivity, Total Cyanide and Sulfide		

Notes:

All samples will be named in accordance with sample nomenclature scheme outlined in Appendix B, SOP-010.

YYQ – YY represents the last two digits of the year during which the sample was collected and Q represents the quarter during which the samples were collected.

SAP Worksheet #19—Analytical SOP Requirements Table (UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Analytical and Preparation Method/ SOP Reference	Containers (Number, Size, and Type)	Sample Volume	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/Analysis) ¹
	Select VOA	SW-846 8260B/ SOP- 202	3-40 milliliter (mL) vials	5 mL	HCL to a pH <2; Cool to 4 ± 2°C; No headspace	14 days to analysis
	Dissolved Iron and Manganese	SW-846 6010B/ SOP- 100,105	500 mL Plastic	50 mL	HNO ₃ to pH<2, Cool to 4 ± 2°C	180 days
	Methane, Ethane, Ethene	RSK-175/ SOP-236	3-40 mL vials	15 mL	Cool to 4 ± 2°C	14 days to analysis
	Volatile Fatty Acids	AM23G	2-40 mL vials	80mL	Benzalkonium chloride, Cool to 4 ± 2°C	14 days from collection
Groundwater	TOC	SW-846 9060/ SOP-221	250 mL Plastic	40 mL	HCL or H ₂ SO ₄ to pH 2 Cool to 4 ± 2°C	28 days
	Nitrate, Nitrite, Sulfate	USEPA 300.0/ SOP- 145	250 mL Plastic	100 mL	Cool to 4 ± 2°C	48 hours to analysis 28 days to analysis
	Sulfide	USEPA 376.1/ SOP- 153	1000 mL Glass	500 mL	Cool to 4 ± 2°C; Zinc acetate and NaOH to pH>9	7 days to analysis
	Alkalinity	USEPA 310.1/ SOP- 154	500 mL Plastic	150 mL	Cool to 4 ± 2°C	14 days to analysis
	TCLPV	SW-846 8260 / SOP- 202	2 X 40 mL amber glass vial	40 mL	Cool to 4 ± 2°C, HCl to pH < 2	14 days to TCLP/ 14 days
	TCLPS	SW-846 3510, 8270 / SOP-201 Empirical	1 L amber glass	300 mL	Cool to 4 ± 2°C	14 days to TCLP/ 7 days /40 days
	TCLPP	SW-846 3510, 8081 / SOP-211 Empirical	1 L amber glass	300 mL	Cool to 4 ± 2°C	14 days to TCLP/ 7 days /40 days
	TCLPH	SW-846 8151A / SOP- 208/304 Empirical	1 L amber glass	300 mL	Cool to 4 ± 2°C	14 days to TCLP/ 7 days/40 days
Aqueous	TCLPM	SW-846 6010, 7470 /SOP-103 Empirical	250 mL plastic	150 mL	Cool to 4 ± 2°C	180 days,28 days (mercury [Hg]) to TCLP/6 months (metals), 28 days (Hg)
	Total Cyanide	SW846 9012A /SOP- 156/164/175 Empirical	250 mL plastic	100 mL	Cool to 4 ± 2°C, NaOH to pH > 12	14 days to analysis
	Total Sulfide	USEPA 376.1/ SOP- 153	1000 mL Glass	500 mL	Cool to 4 ± 2°C; Zinc acetate and NaOH to pH>9	7 days to analysis

SAP Worksheet #19—Analytical SOP Requirements Table (continued)

Matrix	Analytical Group	Analytical and Preparation Method/ SOP Reference	Containers (Number, Size, and Type)	Sample Volume	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/Analysis) ¹
Aqueous	CORR	SW-846 9040 / SOP- 187 Empirical	250 mL plastic	10 mL	Cool to 4 ± 2°C	N/A
IGN		Pensky Martens / SOP- 149 Empirical	250 HIL plastic	50 mL	Cool to 4 ± 2°C	N/A

¹ Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/ extracted.

SAP Worksheet #20—Field Quality Control Sample Summary Table (<u>UFP-QAPP Manual Section 3.1.1</u>)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs	No. of Field Blanks	No. of Equip. Blanks	No. of VOC Trip Blanks	Total No. of Samples to Lab (per round)
Groundwater	Select VOCs (COPCs)	6	1	1/1	One per week of field sampling (1)	One per day of field sampling (approx. 1)	One per cooler shipped (approx. 2)	13
Groundwater	тос	6	1	1/1	One per week of field sampling (1)	One per day of field sampling (approx. 1)	0	11
Groundwater	Methane, Ethane, Ethene	6	1	1/1	One per week of field sampling (1)	One per day of field sampling (approx. 1)	One per cooler shipped (approx. 2)	13
Groundwater	Dissolved Iron and Manganese	6	1	1/1	One per week of field sampling (1)	One per day of field sampling (approx. 1)	0	11
Groundwater	Volatile Fatty Acids	6	1	1/1	One per week of field sampling (1)	One per day of field sampling (approx. 1)	0	11
Groundwater	Alkalinity	6	1	1/1	One per week of field sampling (1)	One per day of field sampling (approx. 1)	0	11
Groundwater	Sulfide	6	1	1/1	One per week of field sampling (1)	One per day of field sampling (approx. 1)	0	11
Groundwater	Nitrate, Nitrite, Sulfate	6	1	1/1	One per week of field sampling (1)	One per day of field sampling (approx. 1)	0	11
Aqueous	TCLPV	1	0	0	0	0	0	1
Aqueous	TCLPS	1	0	0	0	0	0	1
Aqueous	TCLPP	1	0	0	0	0	0	1
Aqueous	TCLPH	1	0	0	0	0	0	1
Aqueous	TCLPM	1	0	0	0	0	0	1

SAP Worksheet #20—Field Quality Control Sample Summary Table (continued)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs	No. of Field Blanks	No. of Equip. Blanks	No. of VOC Trip Blanks	Total No. of Samples to Lab (per round)
Aqueous	Total Cyanide	1	0	0	0	0	0	1
Aqueous	Total Sulfide	1	0	0	0	0	0	1
Aqueous	IGN	1	0	0	0	0	0	1
Aqueous	CORR	1	0	0	0	0	0	1

Note: The details provided in this table are listed per round of groundwater sampling. There are four groundwater sampling event, each of which will be completed following the details provided in this table.

SAP Worksheet #21—Project Sampling SOP References Table (<u>UFP-QAPP Manual Section 3.1.2</u>)

Reference Number	Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP-001	Preparing Field Log Books	CH2M HILL	Log book and indelible pen	N	N/A
SOP-002	Drager Chip Measurement System	Manufacturer	Drager Chip Measurement System	N	N/A
SOP-003	Multi RAE Photoionization Detector	CH2M HILL	Multi RAE	N	N/A
SOP-004	Water Level Measurements	CH2M HILL	Water Level Meter	N	N/A
SOP-005	Low-Flow Groundwater Sampling from Monitoring Wells	CH2M HILL	Flow-through cell with water quality meters, water-level indicator, in-line disposable 0.45 micrometer filters, peristaltic pump, power source, disposable polyethylene tubing, plastic sheeting, well-construction information, calibrated container, watch, sample containers, shipping supplies, and field book	N	N/A
SOP-006	Field Measurement of pH, Specific Conductance, Turbidity, DO, ORP, and Temperature	CH2M HILL	Horiba [®] U-22 with flow-though cell, distilled water in squirt bottle, and Horiba [®] U-22 Auto-Calibration Standard Solution	N	N/A
SOP-007	VOC Sampling – Water	CH2M HILL	Low-flow groundwater sampling equipment and pre- preserved laboratory vials with hydrochloric acid	N	N/A
SOP-008	Equipment Blank and Field Blank Preparation	CH2M HILL	Low-flow groundwater sampling equipment, laboratory grade water, and sample bottles	N	N/A
SOP-009	Sampling Contents of Drums	CH2M HILL	Sampling equipment, non-sparking tools and sample containers	N	N/A
SOP-010	Chain of Custody (CoC)	CH2M HILL	CoC, sample labels, custody seals, indelible pen	N	N/A
SOP-011	Packaging and Shipping Procedures for Low-Concentration Samples	CH2M HILL	Coolers, clear tape, labels, Ziploc®-type bags, bubble wrap, Ice, CoC form (completed), custody seals	N	N/A

SAP Worksheet #21—Project Sampling SOP References Table (cont.)

(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP-012	Decontamination of Personnel and Equipment	CH2M HILL	Deionized, distilled, and potable water, Liquinox® or Alconox®, pesticide grade methanol, plastic tubs, brushes, squirt bottles, plastic bags, and 55-gallon drum(s)	N	N/A
SOP-013	Disposal of Waste Fluids and Solids	CH2M HILL	55-gallon steel drums, tools for securing drum lids, funnel for transferring liquid into drum, labels, paint pens, marking pen for appropriate labels, and seals for 55-gallon steel drums	N	N/A
SOP-014	CHEMets DO Test Kits	Manufacture Instructions	CHEMets DO test kits	N	N/A
SOP-015	HACH Ferrous Iron Test Kits	Manufacture Instructions	HACH Ferrous Iron test kits	N	N/A

Note: Appropriate PPE as detailed in the HSP will be used for all activities.

SAP Worksheet #22—Field Equipment Calibration, Maintenance, Testing, and Inspection Table (<u>UFP-Qapp Manual Section 3.1.2.4</u>)

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference	Comments
Horiba [®] U-22 pH Probe	Calibrate probe using Horiba® U-22 Auto- Calibration Standard Solution	Daily before use, at the end of the day, and when unstable readings occur	pH reads 4.0 ± 3%	Clean probe with deionized water and calibrate again Do not use this instrument if unable to calibrate properly	FTL	Appendix B (SOP-006)	Check mechanical and electronic parts, verify system continuity, check battery, and clean probes Calibration check
Horiba [®] U-22 Specific Conductance Probe	Calibrate probe using Horiba® U-22 Auto- Calibration Standard Solution	Daily before use, at the end of the day, and when unstable readings occur	conductivity reads 4.49 ±3%	Clean probe with deionized water and calibrate again Do not use this instrument if unable to calibrate properly	FTL	Appendix B (SOP-006)	Check mechanical and electronic parts, verify system continuity, check battery, and clean probes Calibration check
Horiba [®] U-22 Turbidity Probe	Calibrate probe using Horiba® U-22 Auto- Calibration Standard Solution	Daily before use, at the end of the day, and when unstable readings occur	turbidity reads 0 ±3%	Clean probe with deionized water and calibrate again Do not use this instrument if unable to calibrate properly	FTL	Appendix B (SOP-006)	Check mechanical and electronic parts, verify system continuity, check battery, and clean probes Calibration check
Horiba [®] U-22 DO and Temperature Probes	Calibrate probe using Horiba® U-22 Auto-Calibration Standard Solution (During calibration of other probes, check these readings against the day's atmospheric pressure and ambient temperature)		Consistent with the current atmospheric pressure and ambient temperature	Clean probe with deionized water and calibrate again Do not use this instrument if unable to calibrate properly	FTL	Appendix B (SOP-006)	Check mechanical and electronic parts, verify system continuity, check battery, and clean probes Calibration check

SAP Worksheet #22—Field Equipment Calibration, Maintenance, Testing, and Inspection Table (cont.)

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference	Comments
Multi RAE Photoionization Detector	Calibrate using ambient air and isobutylene 100ppm calibration gas	Daily, before use	Ambient air reads 0.0 ppm ±3% Isobutylene gas reads 100 ppm ±3%	Follow instructions in manual to clean sensor Do not use this instrument if unable to calibrate properly	FTL	Appendix B (SOP-003)	Daily check alarm and settings before initiating work and recharge after completing work
Groundwater Sampling Pumps and Tubing	No calibration required	Regularly	Maintained in good working order per manufacturer's recommendations	Replace items	FTL	Appendix B (SOP-005)	Inspect pumps, tubing and air/sample line quick-connects
Water Level Indicator	No calibration required	Regularly	Maintained in good working order per manufacturer's recommendations	Clean water level probe with deionized water Replace measurement tape if numbers wear off	FTL	Appendix B (SOP-004)	Inspect water level probe and measurement tape for wear, check battery (9 Volt)
Drager Chips System for VC	Calibration is completed by the manufacturer	Every 500 readings	VC reading between 0.30 and 10.0 parts per million	Send back to manufacturer for replacement/repair. Do not use Drager Chip System if error message appears	FTL	Appendix B (SOP-002)	Check mechanical and electronic parts, verify system continuity, check battery /Recharge as necessary

SAP Worksheet #23—Analytical SOP References Table (UFP-QAPP Manual Section 3.2.1)

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
SOP-100	Metals Digestion/Preparation Methods 3005A, 3010A, 3020A, 3030, 3040A, 3050B, USEPA Contract Laboratory Program (CLP) ILMO 4.1 Aqueous & Soil/Sediment, USEPA Method 200.7(Standard Methods) 3030C, Rev. 19	Definitive	Water/Metals	ICP	Empirical	N
SOP-103	Mercury Analysis in Water by Manual Cold Vapor Technique Methods USEPA SW846 7470A & 245.1 CLP-M 4.1, Rev. 13	Definitive	Water/Metals	Hg Analyzer	Empirical	N
SOP-105	Metals Analysis by ICP Technique Methods 200.7, SW846 6010B,SM 19th Edition 2340B, USEPA ILMO 4.1, Rev. 12	Definitive	Water/Metals	ICP	Empirical	N
SOP-145	Determination of Inorganic Ions in Water by Ion Chromatography using Dionex DX-500 Ion Chromatograph with Hydroxide Eluent and Dionex Column AS18, Method 300.0 Guidance, Rev. 4	Definitive	Water/ Wet Chem	lon chromatography (IC)	Empirical	N
SOP-149	Flashpoint Ignitability Method SW846 1010, Rev. 1	Definitive	Water/ Wet Chem	Flashpoint Tester	Empirical	N
SOP-153	Sulfide Method 376.1 (Titrimetric, Iodine) with Sample Pretreatment to Remove Interfering Substances or to Concentrate Sulfide, Rev. 2	Definitive	Water/ Wet Chem	N/A	Empirical	N
SOP-154	Alkalinity by USEPA Method 310.1, SM2320B, Rev. 3	Definitive	Water/ Wet Chem	N/A	Empirical	N
SOP-156	Reactive Sulfide Method SW-846, Chapter7, Section 7.3.4, Rev. 3	Definitive	Water/ Wet Chem	N/A	Empirical	N
SOP-164	Distillation of Aqueous/Solid Samples for Total and Non- Amenable Cyanide Analysis Methods 335.1/335.4 SW846 9012A/ USEPA CLP ILMO 4.1, Rev. 12	Definitive	Water/ Wet Chem	N/A	Empirical	N
SOP-175	Post-Distillation Analysis for Cyanide by the LACHAT Methods 335.4; SW846 9012A; USEPA-CLP 4.1; Addendum for USEPA CLP ILM 5.2 Aqueous & Soil/Sediment, Rev.9	Definitive	Water/ Wet Chem	LACHAT	Empirical	N
SOP-187	Electrometric Determination of pH, Methods 150.1, Standard Methods 4500-H+B and 9040B for Waters , Liquids, and Liquid Wastes, 9045C for Soils and Solid Wastes, Rev.6	Definitive	Water/ Wet Chem	pH Meter	Empirical	N

SAP Worksheet #23—Analytical SOP References Table (cont.) (UFP-QAPP Manual Section 3.2.1)

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
SOP-198	Toxicity Characteristic Leaching Procedure Method 1311), Rev.5	Definitive	Water/ Wet Chem	NA	Empirical	N
SOP-201	GC/MS Semivolatiles by Method 625 and SW 846 Method 8270C, Rev. 17	Definitive	Water/SVOCs	GC/MS	Empirical	N
SOP-202	GC/MS Volatiles by Method 624 and SW 846 Method 8260B, Rev. 20	Definitive	Water/VOCs	GC/MS	Empirical	N
SOP-208	GC/electron capture detector (ECD) Chlorinated Acid Herbicides by SW846 Method 8150B/8151A, Rev.12	Definitive	Water/Herbicides	GC/ECD	Empirical	N
SOP-211	GC/ECD Organochlorine Pesticides/polychlorinated biphenyls (PCBs) by USEPA Method 608 and SW846 Method 8081A/8082, Rev.18	Definitive	Water/Pesticides/PCBs	GC/ECD	Empirical	N
SOP-221	TOC SM5310C, USEPA Method 415.1 and SW846 Method 9060 and Lloyd Kahn Method, Rev.5	Definitive	Water/Wet Chem	TOC analyzer	Empirical	N
SOP-236	Methane, Ethane, Ethene in Aqueous Samples by Modified RSK-175 (Automated Headspace), Rev.0	Definitive	Water/ GC/HPLC	GC/Flame Ionization Detector (FID)	Empirical	N
SOP-304	Herbicides Aqueous Matrix by Methods USEPA SW846 8151A, Rev.9	Definitive	Water/Herbs Ext.	N/A	Empirical	N
SOP-404	Laboratory Sample Receiving Log-in and Storage SOPs Rev. 10	Definitive	Login	N/A	Empirical	N
SOP-406	Subcontracting Laboratory Samples, Rev.3	Definitive	Subcontracting	N/A	Empirical	N
SOP-410	SOPs for Laboratory Sample Storage, Secure Areas, and Sample Custody, Rev. 4	Definitive	Login	N/A	Empirical	N
AM23G	Low Level Volatile Fatty Acids by Ion Chromatography, Rev.3	Definitive	Volatile Fatty Acids	IC	Microseeps	N

SAP Worksheet #24—Analytical Instrument Calibration Table (UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/MS	Minimum five point calibration for all analytes	Prior to sample analysis or instrument change, when instrument does not meet method criteria	30% relative standard deviation (RSD) for calibration check compounds (CCCs) and Minimum RF for system performance check compounds (SPCCs), 15% for Average RF, 0.995 correlation for Quadratic	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Analyst/Supervisor	Empirical SOP- 202
GC/ECD	Minimum five point calibration for all analytes	Prior to sample analysis or instrument change, when instrument does not meet method criteria	20% RSD, Minimum correlation. 0.995 Linear, 0.99 Quadratic	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Analyst/Supervisor	Empirical SOP- 211/208
GC/FID	Minimum five point calibration for all analytes	Prior to sample analysis or instrument change, when instrument does not meet method criteria	20%RSD, Minimum correlation. 0.995 Linear, 0.99 Quadratic	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Analyst/Supervisor	Empirical SOP- 236
pH Meter	Calibrate meter at pH 7 and 4, check 7 again and pH 10	Before analysis and check every 3 hours	4 and 7 + .05 pH units, pH 10 + 0.10 pH units, +0.20 pH units for check	Recalibrate as necessary	Analyst/Supervisor	Empirical SOP- 154
ICP	One point calibration per manufacturers guidelines	At the beginning of each day or if QC is outside criteria	90-110% of true value	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst/Supervisor	Empirical SOP- 105

SAP Worksheet #24—Analytical Instrument Calibration Table (cont.)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
TOC Analyzer	Six-point curve	Prior to sample analysis or instrument change, when instrument does not meet method criteria	0.995 correlation linear	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Analyst/Supervisor	Empirical SOP-221
LACHAT	Minimum five-point calibration	At the beginning of each day or if QC is outside criteria		Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Analyst/Supervisor	Empirical SOP-175
Hg Analyzer/FIMS	Minimum five-point calibration	At the beginning of each day or if QC is outside criteria		Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst/Supervisor	Empirical SOP-103
Flashpoint Tester	Flashpoint of p-xylene	At the beginning and end of each set of 20 samples or less		Check standard	Analyst/Supervisor	Empirical SOP-149

SAP Worksheet #24—Analytical Instrument Calibration Table (cont.)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
IC	Eight-point curve	Prior to sample analysis or instrument change, when instrument does not meet method criteria	15% RSD, 0.995 linear	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Analyst/Supervisor	Empirical SOP-145
IC	Five-point curve	As needed based upon results of calibrations checks, CCVs - 1 per 20 samples and at end of shift	Coefficient of Determination ≥ 0.995	Reprepare and reanalyze, if still out of control recalibrate	Analyst	Microseeps Sections 4.1 and 5.2.3

SAP Worksheet #25—Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.2.3)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GCMS	Check gas supply daily, Bake or change trap as necessary, Manual tune if 4-bromofluoroben- zene (BFB)/ decafluoro- triphenylphosphine (DFTPP) not within criteria, Cut column, change septum as needed	VOC Analysis	Ion source, seal septum, liner	Prior to sample analysis or, when instrument does not meet method criteria	30% RSD CCCs, Minimum RF SPCCs, 15% Average RSD, 0.995 linear, 0.99 correlation. Quadratic initial cal; 20% difference CCV for CCCs, Minimum RF SPCCs	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Analyst/ Supervisor	Empirical SOP-202
GC/ECD	Check gas supply daily, Change liner, septum, seal. Cut column as needed	Pest/Herb Analysis	Seal, septum, liner	Prior to sample analysis or instrument change, when instrument does not meet method criteria	20% RSD, Minimum correlation. 0.995 Linear, 0.99 Quadratic	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Analyst/ Supervisor	Empirical SOP-208/211
GC/FID	Check gas supply daily, Change FID jet as needed	Methane, Ethane, Ethene Analysis	Check gas supply daily, Change FID jet as needed	Prior to sample analysis or instrument change, when instrument does not meet method criteria	20%RSD, Minimum correlation. 0.995 Linear, 0.99 Quadratic	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Analyst/ Supervisor	Empirical SOP-236
LACHAT	Degas solutions, change tubing, lamp, clean connectors	Cyanide	Tubing, rollers	At the beginning of each day or when QC is outside criteria	Correlation coefficient >0.997	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst/ Supervisor	Empirical SOP-175

SAP Worksheet #25—Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (cont.)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Hg Analyzer	Change tubing, change filter, clean windows, check gas flow, Check reagents and standards	Hg Analysis	Change tubing, change filter, clean windows, check gas flow, Check reagents and standards	At the beginning of each day or when QC is outside criteria	Correlation coefficient >0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst/ Supervisor	Empirical SOP-103
Flashpoint Tester	Change propane tank, calibrate thermometer	Flashpoint	Tank, thermometer	Before use	Flash at 27°C, + 2.2°C	Check standard	Analyst/ Supervisor	Empirical SOP-149
pH meter	Change buffer solutions or pH probe	Alkalinity	Calibration	Before analysis begins, check every 3 hours	4 and 7 + .05 pH units, pH 10 + 0.10 pH units, + 0.20 pH units for check	Recalibrate as necessary	Analyst/ Supervisor	Empirical SOP-154
IC	Replace column	Volatile Fatty Acids	Check for leaks, check pistons	As needed for column, daily		Replace tubing and pistons as needed	Analyst	Microseeps AM23G
IC	Replace column	Anions	Check gas supply daily, tubing	As needed	0.995 linear, 10% diff CCV	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Analyst/ Supervisor	Empirical SOP-145
TOC analyzer	Clean syringe, replace scrubber as needed, change filters as needed	TOC	Check gas supply, Check lamp, tubing, reagent volumes	Prior to sample analysis or, when instrument does not meet method criteria	0.995 linear, 10% diff CCV	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Analyst/ Supervisor	Empirical SOP-221

SAP Worksheet #26-1—Sample Handling System

(UFP-QAPP Manual Appendix A)

Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT

Sample Collection (Personnel/Organization): FTL/ JV 2 (To be determined)

Sample Packaging (Personnel/Organization): FTL/ JV 2 (To be determined)

Coordination of Shipment (Personnel/Organization): FTL/ JV 2 (To be determined)

Type of Shipment/Carrier: FedEx/Overnight shipment to Empirical Laboratories

SAMPLE RECEIPT AND ANALYSIS

Sample Receipt (Personnel/Organization): E. Overby/Empirical Laboratories

Sample Custody and Storage (Personnel/Organization): E. Overby/ Empirical Laboratories

Sample Preparation (Personnel/Organization): B. DeVille, C. Thompson/ Empirical Laboratories

Sample Determinative Analysis (Personnel/Organization): B. DeVille, T. Monteiro, J. Holliman/Empirical Laboratories

SAMPLE ARCHIVING

Field Sample Storage (No. of days from sample collection): 90 days from receipt

Sample Extract/Digestate Storage (No. of days from extraction/digestion): 1 year

Biological Sample Storage (No. of days from sample collection): N/A

SAMPLE DISPOSAL

Personnel/Organization: E. Overby/ Empirical Laboratories

Number of Days from Analysis: 90 days from receipt

SAP Worksheet #26-2—Sample's Life Flowchart

A Sample's Life

Step-by-Step Outline of Data Management Process and Roles & Responsibilities

Planning Phase



- Kickoff Meeting
- · Project Instructions (Pls)



Sample Collection



- Daily collection and shipments of
- One COC/cooler; One FedEx slip/cooler
- Field team coordinates w/ EIS for tracking & Lab notification
- GPS conducted (if applicable)

Step 2B Sample Tracking



- EIS cross checks COC against PIs
- Also reviews lab confirmation sheets to verify all samples were received and in appropriate condition

Step 3

Lab Analysis



- · Standard 28-day unless otherwise arranged
- · EIS reviews data for accuracy and works with lab to resolve discrepancies
- Chemist is informed of any analytical issues such as multiple dilutions or surrogates out
- EIS tracks schedule and keeps PM informed
- · EIS inputs Field Data Entry Tool information from Log Books
- EIS can generate Unvalidated Raw and Detects Data Tables

Data Validation



- · EIS reviews all data for accuracy against the
- · EIS sends data from lab to Data Validator
- · Delays may occur if there is missing data or data is late from the lab
- · EIS can generate Validated Raw and Detects Data Tables

Data Load

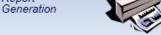


- Chemist performs a pre-load check on data. This involves a complete review and comparison of the hardcopy data, SNEDD, and data validation
- Chemist requests revisions from data validator if necessary then submits to EIS when complete
- EIS sends data to Database Specialist to be loaded into Environmental Database (EnDat)

Quality Assurance/ Quality Control

- EIS is sent tables from Database Specialist for QA/QC check
- EIS verifies info loaded is correct (Sample, Station, Analyses, Result)
- EIS then helps decide whether info needs to be updated or not
- File and archive all Lab and DV deliverables

Report



- · Raw, Detects, Exceedance Reports
- · Data Requests
- Exceedance Reports (criteria needed prior to this step and selected by PM)
- · Human Health Risk Assessment
- Eco Risk Assessment

End of our Sample's Life?



- · Data may be used in reports, posted on web, put into GIS, etc
- In that regard, a sample's life doesn't really ever

SAP Worksheet #27—Sample Custody Requirements Table

(UFP-QAPP Manual Section 3.3.3)

Sample Labeling Procedures

Sample labels will include, at a minimum, client name, site, sample ID, date/time collected, preservative use, analysis group or method, and sampler's initials. A standardized numbering system specific for NSN will be used to identify all samples collected. The numbering system will provide a tracking procedure to ensure accurate data retrieval of all samples collected. Each sample will be designated by an alphanumeric code that will identify the facility, site, station ID, matrix sampled, and/or date and depth sampled. QA/QC samples will have a unique sample designation. The sample identification scheme for all samples collected during the investigation will use the format shown in **Appendix B**, **SOP-010**. The field logbook will identify the sample ID with the location, depth, date/time collected, and the parameters requested.

Field Sample Custody Procedures (Sample Collection, Packaging, Shipment, and Delivery to Laboratory)

Field samples will be collected by the field team members under the supervision of the FTL. As samples are collected, they will immediately be placed in the appropriate containers and labeled, as outlined above. The labels will be filled out in the field by the field crew at the time of sample collection and QC'd before being placed into the cooler, at which time the sample will be logged in on the CoC form and field logbook. The integrity of the sample labels will be maintained through the practice of placing sample containers in Ziploc®-type bags.

Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples below 4°C until they are received by the laboratory. The CoC will also be placed into the cooler inside a Ziploc®-type bag and taped to the top of the inside of the cooler.

Coolers will be shipped to the laboratory via FedEx, with the airbill number indicated on the CoC (to relinquish custody). The FTL is responsible for the care and custody of samples until they are shipped or otherwise delivered to the laboratory custodian. Upon delivery, the laboratory will log in each cooler and report the status of the samples as discussed below.

Chain-of-custody Procedures

CoCs will include, at a minimum, laboratory contact information, client contact information, sample information, and relinquished by/received by information (Appendix B, SOP-010). Sample information will include sample ID, date/time collected, number and type of containers, preservative information, analysis method, and comments. The CoC will also have the sampler's name and signature. The CoC will link location of the sample from the field logbook to the laboratory receipt of the sample. The laboratory will use the sample information to populate the laboratory information management system (LIMS) database for each sample. For subcontracting of Volatile Fatty Acids analysis, Empirical Laboratories will receive samples and ship to Microseeps, Inc. in Pittsburgh, Pennsylvania according to their internal Subcontracting and CoC procedures. See Empirical SOP 406 for more information.

Laboratory Sample Custody Procedures (Receipt of Samples, Archiving, Disposal)

The laboratory receiving samples will comply with all sample custody requirements outlined in the laboratory SOPs 404 and 410. The SOPs for documenting sample custody and examples of a CoC form and a custody seal are provided in **Appendix B**, **SOP-010**.

Sample Integrity

A sample tracking system will be followed to ensure sample authenticity and data defensibility. A field team member or an EIS will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. The EIS will ensure that samples have arrived to the laboratory in the appropriate timeframe and the condition of samples upon receipt is satisfactory. If samples are not delivered to the laboratory in the acceptable timeframe or condition, the PM will be notified and the decision will be made whether to recollect samples.

The EIS is responsible for checking the CoC forms against the field logbook and field project instructions to verify the sample ID, times, analyses, and methods are correct on the CoC form. Any discrepancies will be resolved with the field team and relayed to the laboratory. These actions will be documented by both the laboratory and the EIS. The laboratory is responsible for providing the EIS with sample log-in sheets the day of sample receipt in order for the EIS to verify the laboratory has accounted for all samples shipped and has correctly logged the samples into its software system.

VC: 50-145%

or 20

samples

VC: 50-145%

SAP Worksheet #28-1—QC Samples Table
The laboratory's performance criteria for LCS, Matrix Spike, and Duplicates are adequate to meet the Data Quality Indicators for this project.

Matrix	Groundwater					
Analytical Group	VOCs (TCE, VC, cis-1,2-DCE, 1,1-DCE)					
Analytical Method/ SOP Reference	SW846 8260B/ SOP- 202					
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicators	Measurement Performance Criteria
Method Blank	One every 12 hours prior to sample analysis	Targets < ½ RL	Reanalyze or qualify data	Analyst/ Supervisor/ QC Officer	Bias/ Contamination	Targets < ½ RL
Surrogates	3 per sample	Control limits: 1,2-DCA-d4: 70-120% 4-Bromofluorobenzene: 75-120% Dibromofluoromethane: 85-115% Toluene-d8: 85-120%	Reanalyze for confirmation of matrix interference when appropriate	Analyst/ Supervisor/ QC Officer	Accuracy/ Bias	Control limits: 1,2-DCA-d4: 70-120% 4-Bromofluorobenzene: 75-120% Dibromofluoromethane: 85-115% Toluene-d8: 85-120%
Internal Standards	3 per sample	RT + 30 seconds, EICP area within -50% to +100% of last calibration verification(12 hours) for each IS	Inspect GCMS for malfunctions, mandatory reanalysis of samples analyzed while system was malfunctioning	Analyst/ Supervisor/ QC Officer	Precision/ Accuracy/ Bias	RT + 30 seconds, EICP area within -50% to +100% of last calibration verification(12 hours) for each IS
LCS	One per sample delivery group (SDG)	% Recovery: TCE: 70-125% Cis-1,2-DCE: 70-125% 1,1-DCE: 70-130%	Reanalyze or qualify data	Analyst/ Supervisor/ QC Officer	Precision/ Accuracy/ Bias	% Recovery: TCE: 70-125% Cis-1,2-DCE: 70-125% 1,1-DCE: 70-130%

SAP Worksheet #28-1— QC Samples Table (continued)

Matrix	Groundwater
Analytical Group	VOCs (TCE, VC, cis-1,2-DCE, 1,1-DCE)
Analytical Method/ SOP Reference	SW846 8260B/ SOP- 202

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MS/ MSD	One per SDG or 20 samples	% Recovery: TCE: 70-125% Cis-1,2-DCE: 70-125% 1,1-DCE: 70-130% VC: 50-145%	Corrective Action will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable reanalyze samples and QC.	Analyst/ Supervisor/ QC Officer	Precision/ Accuracy/ Bias	% Recovery: TCE: 70-125% Cis-1,2-DCE: 70-125% 1,1-DCE: 70-130% VC: 50-145%

SAP Worksheet #28-2—QC Samples Table

Matrix	Groundwater					
Analytical Group	Wet Chemistry: Methane, Ethane, Ethene					
Analytical Method/SOP Reference	RSK-175/ SOP- 236					
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per batch of 20 or less	Targets < ½ RL	Data qualified	Analyst/Supervisor/ QC Officer	Bias / Contamination	Targets < ½ RL
LCS	One per batch of 20 or less	75-125%	If no target compounds are detected in the LCS, then all samples should be reanalyzed. If targets are detected in the LCS within acceptance limits, then no corrective action is needed.	Analyst/Supervisor/ QC Officer	Accuracy/Bias	75-125%
MS/MSD	One per batch of 20 or less	75-125%	Corrective Action will not be taken for samples when recoveries are outside limits and LCS criteria are met. If both the LCS and MS/MSD are unacceptable reanalyze samples and QC.	Analyst/Supervisor/ QC Officer	Accuracy/Bias	75-125%

SAP Worksheet #28-3—QC Samples Table

Matrix	Groundwater					
Analytical Group	Wet Chemistry: Nitrate, Nitrite, Sulfate					
Analytical Method/ SOP Reference	USEPA 300.0/ SOP-145					
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Reagent Blank	One per batch	Targets < ½ RL	If Reagent Blank is higher than RL, all samples < 10x blank must be reanalyzed	Analyst/Supervisor/ QC Officer	Bias/ Contamination	Targets < ½ RL
Lab Fortified Blank	One per batch	MRL to 10x MRL 75- 125%; 10x MRL to highest Cal level 85- 115%	If laboratory-fortified blank (LFB) is out high and sample concentrations are <rl, action.="" all="" be="" corrective="" must="" no="" otherwise="" reanalyzed.<="" samples="" td=""><td>Analyst/Supervisor/ QC Officer</td><td>Accuracy/Bias</td><td>MRL to 10x MRL 75- 125%; 10x MRL to highest Cal level 85- 115%</td></rl,>	Analyst/Supervisor/ QC Officer	Accuracy/Bias	MRL to 10x MRL 75- 125%; 10x MRL to highest Cal level 85- 115%
Instrument Performance Check	One per batch	RT shifts < 2%	Column may require cleaning or replacement	Analyst/Supervisor/ QC Officer	Accuracy/Bias	RT shifts < 2%
Lab Fortified Sample Matrix	Minimum of 10% of lab samples	Recovery 80-120%	If analyte level >4x spiking level, % recovery cannot be evaluated and no Corrective Action. If not sample data qualified.	Analyst/Supervisor/ QC Officer	Accuracy/Bias	Recovery 80-120%
Field or lab duplicate	Minimum of 10% of lab samples	MRL to 10x MRL +20%; 10x MRL to highest Cal level +10%	Associated data qualified	Analyst/Supervisor/ QC Officer	Precision	MRL to 10x MRL +20%; 10x MRL to highest Cal level +10%

SAP Worksheet #28-4—QC Samples Table

Matrix	Groundwater
Analytical Group	Wet
	Chemistry:
	Sulfide
Analytical	USEPA 376.1/
Method/ SOP	SOP-153
Reference	

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per batch or less	Targets < ½ RL	If Method Blank is higher than RL, all samples < 10x blank must be reanalyzed	Analyst/Supervisor/ QC Officer	Bias/ Contamination	Targets < ½ RL
Laboratory Control Sample	One per batch or less	Recovery 80-120%	If LCS is out high and sample concentrations are <rl, action.="" all="" be="" corrective="" must="" no="" otherwise="" reanalyzed.<="" samples="" td=""><td>Analyst/Supervisor/ QC Officer</td><td>Accuracy/Bias</td><td>Recovery 80-120%</td></rl,>	Analyst/Supervisor/ QC Officer	Accuracy/Bias	Recovery 80-120%
Duplicate	One per batch or less	RPD <20%	If RPD >20% and adequate sample volume, sample should be reanalyzed, if still high, result is flagged.	Analyst/Supervisor/ QC Officer	Precision	RPD <20%

SAP Worksheet #28-5—QC Samples Table

Matrix	Groundwater					
Analytical Group	Wet Chemistry: Alkalinity					
Analytical Method/ SOP Reference	USEPA 310.1/ SOP- 154					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per batch of 20 or less	Targets < ½ RL	If Method Blank is higher than RL, all samples < 10x blank must be reanalyzed	Analyst/Supervisor/ QC Officer	Bias / Contamination	Targets < ½ RL
Sample Duplicate	One per batch of 20 or less	RPD <20%	If RPD >20%, sample should be reanalyzed, if still high, result is flagged.	Analyst/Supervisor/ QC Officer	Precision	RPD <20%
Laboratory Control Sample	One per batch of 20 or less	Result between 80- 120%	If LCS is out high and sample concentrations are <rl, action.="" all<="" corrective="" no="" otherwise="" td=""><td>Analyst/Supervisor/ QC Officer</td><td>Accuracy/Bias</td><td>Result between 80- 120%</td></rl,>	Analyst/Supervisor/ QC Officer	Accuracy/Bias	Result between 80- 120%

samples must be reanalyzed.

concentration.

SAP Worksheet #28-6—QC Samples Table

Matrix	Groundwater					
Analytical Group	Wet Chemistry: Volatile Fatty Acids					
Analytical Method/ SOP Reference	AM23G/ AM23G					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS	per analytical batch or per twenty (whichever is more frequent)	70-130% recovery	prepare fresh LCS and re-analyze, if it still fails, correct problem and re- analyze all samples run since last passing LCS	analyst	Accuracy/ Bias	70-130% recovery
MS	per analytical batch or per twenty (whichever is more frequent)	70-130% recovery	If all else is acceptable, note in relevant case narratives and proceed	analyst	Accuracy/ Bias/ Precision	70-130% recovery
MSD	per analytical batch or per twenty (whichever is more frequent)	RPD ≤ 30%	If all else is acceptable, note in relevant case narratives and proceed	analyst	Accuracy/ Bias/ Precision	RPD ≤ 30%
ICAL	as needed	Coefficient of Determination ≥ 0.995	inspect/repair system and then recalibrate	analyst	Accuracy/ Bias	Coefficient of Determination ≥ 0.995
Initial Calibration Verification (ICV)	immediately following ICAL	At or within ± 20% of the known true	inspect/repair system and then recalibrate	analyst	Accuracy/ Bias	At or within ± 20% of the known true

concentration.

SAP Worksheet #28-6—QC Samples Table (cont.)

Matrix	Groundwater					
Analytical Group	Wet Chemistry: Volatile Fatty Acids					
Analytical Method/ SOP Reference	AM23G/ AM23G					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
CCV	per analytical batch or per twenty (whichever is more frequent)	At or within ± 20% of the known true concentration.	Inspect/ repair system and then repeat, with either a passing CCV or ICAL. All samples analyzed since last passing CCV/CCB must be reanalyzed.	analyst	Accuracy/ Bias	At or within ± 20% of the known true concentration.
CCB	per analytical batch or per twenty (whichever is more frequent)	no target analytes above reporting limits	Inspect/ repair system and then repeat, with either a passing CCV or ICAL. All samples analyzed since last passing CCV/CCB must be reanalyzed.	analyst	Accuracy/ Bias	no target analytes above reporting limits

SAP Worksheet #28-7—QC Samples Table

Matrix	Groundwater
Analytical Group	Wet Chemistry: TOC
Analytical Method/SOP Reference	9060/SOP-221

Reference						
QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per batch	Targets < ½ RL	Reanalyze samples	Analyst/Supervisor	Bias / Contamination	Targets < ½ RL
LCS	One per batch	80-120%	Recalibrate and reanalyze samples	Analyst/Supervisor	Accuracy/Bias	80-120%
MS/MSD	One per batch	75-125%	Corrective Action will not be taken for samples when recoveries are outside limits and LCS criteria are met. If both the LCS and MS/MSD are unacceptable reanalyze samples and QC.	Analyst/Supervisor	Accuracy/Bias	75-125%

SAP Worksheet #28-8—QC Samples Table

Analytical	Discolused bear and
Group	Dissolved Iron and Manganese
Analytical Method/ SOP Reference	SW846 6010B/ SOP- 100,105

Reference						
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples	Targets < ½ RL	Investigate source of contamination. Redigest and reanalyze all associated samples if sample concentration > QL and < 10x blank concentration.	Laboratory Supervisor	Bias/Contamination	Targets < ½ RL
LCS	One per digestion batch of 20 or fewer samples	% Recovery: Iron: 80-120% Manganese: 80- 120%	Investigate source of problem. 2) Redigest and reanalyze all associated samples.	Laboratory Supervisor	Accuracy/Bias	% Recovery: Iron: 80-120% Manganese: 80-120%
Duplicate Sample	One per digestion batch of 20 or fewer samples	20% RPD	Qualify results	Laboratory Supervisor	Precision	20% RPD
MS	One per digestion batch of 20 or fewer samples	% Recovery: Iron: 80-120% Manganese: 80- 120%	Qualify results	Laboratory Supervisor	Accuracy/Bias	% Recovery: Iron: 80-120% Manganese: 80-120%

SAP Worksheet #28-8—QC Samples Table (cont.)

Matrix	Groundwater					
Analytical Group	Dissolved Iron and Manganese					
Analytical Method/ SOP Reference	SW846 6010B/ SOP- 100,105					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
ICP Serial Dilution	One per digestion batch	If original sample result is at least 50x IDL, 5-fold dilution must agree within 10% of original result	Qualify result or dilute and reanalyze sample to eliminate interference	Laboratory Supervisor	Accuracy/Bias	If original sample result is at least 50x IDL, 5-fold dilution must agree within 10% of original result

SAP Worksheet #28-9— QC Samples Table

Matrix:	Aqueous
Analytical Group:	TCLPV
Analytical Method / SOP Reference:	SW846 1311, 8260B / SOP-198, 202

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	Every 12 hours	Targets < ½ RL	Re-clean and re- analyze	Laboratory Supervisor	Bias / Contamination	Targets < ½ RL
Surrogates	Each sample	Must meet acceptance criteria presented in SOP 202.	Check instrument performance, re- analyze and qualify data	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 202.
LCS	1 per batch or 1 per 20 samples	Must meet acceptance criteria presented in SOP 202.	Check instrument performance, reanalyze	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 202.
LCSD	1 per batch or 1 per 20 samples if no MS/MSD	Must meet acceptance criteria presented in SOP 202.	Check instrument performance, reanalyze	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 202.
MS/ MSD	Every 20 samples	Must meet acceptance criteria presented in SOP 202.	Check instrument performance, qualify data	Laboratory Supervisor	Precision / Accuracy / Bias	Must meet acceptance criteria presented in SOP 202.
Internal Standards	Each sample	Area counts –50% to +100% of Initial Calibration IS or continuing calibration IS area counts; RTs ±30 seconds of continuing calibration	Check instrument performance, reanalyze and qualify data	Laboratory Supervisor	Precision / Accuracy / Bias	Area counts –50% to +100% of Initial Calibration IS or continuing calibration IS area counts; RTs ±30 seconds of continuing calibration

SAP Worksheet #28-10—QC Samples Table

Matrix:	Aqueous
Analytical Group:	TCLPS
Analytical Method / SOP Reference:	SW846 1311, 8270C / SOP-198, 201

	201					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch or 1 per 20 samples	Targets < ½ RL	Re-clean and re- analyze	Laboratory Supervisor	Bias / Contamination	Targets < ½ RL
Surrogates	Each sample	Must meet acceptance criteria presented in SOP 201.	Check instrument performance, reanalyze and qualify data	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 201.
LCS	1 per batch or 1 per 20 samples	Must meet acceptance criteria presented in SOP 201.	Check instrument performance, reanalyze	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 201.
LCSD	1 per batch or 1 per 20 samples if no MS/MSD	Must meet acceptance criteria presented in SOP 201.	Check instrument performance, reanalyze	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 201.
Internal Standards	Each sample	Area counts –50% to +100% of initial calibration IS or continuing calibration IS area counts; RTs ±30 seconds of continuing calibration	Check instrument performance, reanalyze and qualify data	Laboratory Supervisor	Precision / Accuracy / Bias	Area counts –50% to +100% of Initial Calibration IS or continuing calibration IS area counts; RTs ±30 seconds of continuing calibration
MS/MSD	Every 20 samples	Must meet acceptance criteria presented in SOP 201.	Check instrument performance, qualify data	Laboratory Supervisor	Precision / Accuracy / Bias	Must meet acceptance criteria presented in SOP 201.

SAP Worksheet #28-11 —QC Samples Table

Matrix:	Aqueous
Analytical Group:	TCLPP
Analytical Method / SOP Reference:	SW846 1311, 8081A / SOP-198, 211

	211					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch or 1 per 20 samples	Targets < ½ RL	Re-clean and re- analyze	Laboratory Supervisor	Bias / Contamination	Targets < ½ RL
Surrogates	Each sample	Must meet acceptance criteria presented in SOP 211.	Check instrument performance, reanalyze, qualify data	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 211.
LCS	1 per batch or 1 per 20 samples	Must meet acceptance criteria presented in SOP 211.	Check instrument performance, reanalyze	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 211.
LCSD	1 per batch or 1 per 20 samples if no MS/MSD	Must meet acceptance criteria presented in SOP 211.	Check instrument performance, reanalyze	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 211.
MS/ MSD	Every 20 samples	Must meet acceptance criteria presented in SOP 211.	Check instrument performance, qualify data	Laboratory Supervisor	Precision / Accuracy / Bias	Must meet acceptance criteria presented in SOP 211.

SAP Worksheet #28-12 —QC Samples Table

Matrix:	Aqueous
Analytical Group:	TCLPM
Analytical Method / SOP Reference:	SW846 1311, 6010B, 7470A / SOP-198, 103, 105

	SOP-198, 103, 105					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch or 1 per 20 samples	Targets < ½ RL	Re-digest and reanalyze	Laboratory Supervisor	Bias / Contamination	Targets < ½ RL
LCS	1 per batch or 1 per 20 samples	Must meet acceptance criteria presented in SOP 103, 105.	Re-digest and reanalyze	Laboratory Supervisor	Accuracy / Bias / Contamination	Must meet acceptance criteria presented in SOP 103, 105
Duplicate Sample	1 per 20 samples	Must meet acceptance criteria presented in SOP 103, 105	Qualify Data	Laboratory Supervisor	Precision	Must meet acceptance criteria presented in SOP 103, 105
MS	1 per 20 samples	RPD <=20%	Perform post-digestion spike analysis, qualify data	Laboratory Supervisor	Accuracy / Bias	RPD <=20%
Post-digestion Spike	For compounds outside of QC limits in Matrix Spike	Must meet acceptance criteria presented in SOP 103, 105	Qualify data	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 103, 105
ICP Serial Dilution	Per analytical run	%Difference 90% - 110%	Qualify data	Laboratory Supervisor	Accuracy / Bias	%Difference 90% - 110%

SAP Worksheet #28-13—QC Samples Table

Matrix:	Aqueous
Analytical Group:	TCLPH
Analytical Method / SOP Reference:	SW846 1311, 8151A / SOP-198, 208, 304

	208, 304					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch or 1 per 20 samples	Targets < ½ RL	Re-clean and re- analyze	Laboratory Supervisor	Bias / Contamination	Targets < ½ RL
Surrogates	Each sample	Must meet acceptance criteria presented in SOP 208, 304.	Check instrument performance, reanalyze, qualify data	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 208, 304.
LCS	1 per batch or 1 per 20 samples	Must meet acceptance criteria presented in SOP 208, 304.	Check instrument performance, reanalyze	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 208, 304.
LCSD	1 per batch or 1 per 20 samples if no MS/MSD	Must meet acceptance criteria presented in SOP 208, 304.	Check instrument performance, reanalyze	Laboratory Supervisor	Accuracy / Bias	Must meet acceptance criteria presented in SOP 208, 304.
MS/ MSD	Every 20 samples	Must meet acceptance criteria presented in SOP 208, 304.	Check instrument performance, qualify data	Laboratory Supervisor	Precision / Accuracy / Bias	Must meet acceptance criteria presented in SOP 208, 304.

SAP Worksheet #28-14 —QC Samples Table

Matrix:	Aqueous		
Analytical Group:	Total Cyanide		
Analytical Method / SOP Reference:	SW846 9012A / SOP-156		

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per batch	Targets < ½ RL	Re-clean and re- analyze	Laboratory Supervisor	Bias/Contamination	Targets < ½ RL
LCS/ LCSD	One per batch of 20 or fewer samples (include LCSD if no MSD in batch)	cyanide = %Recovery 0% - 12.4%	Recalibrate/reanalyze	Laboratory Supervisor	Accuracy, Precision	%Recovery 0% - 12.4%

SAP Worksheet #28-15—QC Samples Table

Matrix	Aqueous
Analytical Group	Wet
	Chemistry:
	Sulfide
Analytical	USEPA 376.1/
Method/ SOP	SOP-153
Reference	

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per batch or less	Targets < ½ RL	If Method Blank is higher than RL, all samples < 10x blank must be reanalyzed	Analyst/Supervisor/ QC Officer	Bias/ Contamination	Targets < ½ RL
Laboratory Control Sample	One per batch or less	Recovery 80-120%	If LCS is out high and sample concentrations are <rl, action.="" all="" be="" corrective="" must="" no="" otherwise="" reanalyzed.<="" samples="" td=""><td>Analyst/Supervisor/ QC Officer</td><td>Accuracy/Bias</td><td>Recovery 80-120%</td></rl,>	Analyst/Supervisor/ QC Officer	Accuracy/Bias	Recovery 80-120%
Duplicate	One per batch or less	RPD <20%	If RPD >20% and adequate sample volume, sample should be reanalyzed, if still high, result is flagged.	Analyst/Supervisor/ QC Officer	Precision	RPD <20%

SAP Worksheet #28-16 —QC Samples Table

Matrix:	Aqueous					
Analytical Group:	CORR					
Analytical Method / SOP Reference:	SW-846 9040 / SOP-187					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS (pH 7.0 buffer)	Every 10 samples	±0.05 pH units	Recalibrate/ reanalyze	Laboratory Supervisor	Accuracy, Precision	±0.05 pH units
Duplicate	One set per 20 field samples	RPD ≤ 20%	Qualify Data	Laboratory Supervisor	Precision	RPD ≤ 20%

SAP Worksheet #28-17 —QC Samples Table

Matrix:	Aqueous					
Analytical Group:	IGN					
Analytical Method / SOP Reference:	Pensky Martens / SOP-149					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS	One per batch of 20 or fewer samples	% Recovery 80% - 120%	Reanalyze	Laboratory Supervisor	Accuracy	%Recovery 80% - 120%
Duplicate	One set per 20 field samples, for every sample that flashes, or extinguishes flame <140°C	RPD ≤ 20%	Repeat, Qualify Data	Laboratory Supervisor	Precision	RPD ≤ 20%

SAP Worksheet #29—Project Documents and Records Table (<u>UFP-QAPP Manual Section 3.5.1</u>)

Document	Where Maintained
Field Logbook	Project Files
Groundwater Monitoring Technical Memorandums	Project Files
Partnering Presentations	Project Files; Meeting Minutes

SAP Worksheet #30—Analytical Services Table

(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Locations/ ID Number	Analytical Method	Data Package Turnaround Time	Laboratory/ Organization	Backup Laboratory/ Organization ¹
	Volatile fatty acids		AM23G		Microseeps, Inc. Debbie Hallo 220 William Pitt Way Pittsburgh, PA 15238 Phone 412 826 5245	
	Select VOCs		SW846 8260B			
Groundwater	MEE		RSK-175		Empirical Laboratories Marcia McGinnity 227 French Landing Drive, Suite 550 Nashville, TN 37228 615-345-1115	TBD
	Nitrate, Nitrite, Sulfate		USEPA 300.0			
	Sulfide	See Worksheet #18	USEPA 376.2	28 calendar days		
	Alkalinity		USEPA 310.2			
	TOC		SW846 9060			
	Dissolved As, Fe, Mn		SW846 6010B			
	TCLP-VOCs		SW846 1311/ 8260B			
	TCLP-SVOCs		SW846 1311/ 8270C			
	TCLP-Pesticides		SW846 1311/ 8081A			
	TCLP-Herbicides		SW846 1311/ 8151A			
Aqueous	TCLP-Metals		SW846 1311/ 6010B/ 7470A			
	Ignitability		Pensky Martens			
	Total Cyanide and Sulfide		SW846 9012, EPA 376.1			
	Corrosivity		SW846 9040C			

¹ To be determined. If circumstances arise that render Empirical unable to provide analytical services, a backup laboratory will be chosen at that time.

SAP Worksheet #31—Planned Project Assessments Table (<u>UFP-QAPP Manual Section 4.1.1</u>)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Action	Person(s) Responsible for Monitoring Effectiveness of Corrective Action
Offsite Laboratory Technical Systems Audit	Laboratory must have current Naval Facilities Engineering Service Center (NFESC) evaluation letter which will identify the period of performance. The laboratory must be reevaluated prior to expiration of period of performance	External	U.S. Navy (NFESC)	Project QA Officer- Pati Moreno/ NFESC, Port Hueneme, Corrective Action	Randy Ward, Empirical Laboratory QA Officer	Randy Ward, Empirical Laboratory QA Officer	Anita Dodson, JV 2 Program Chemist

SAP Worksheet #32-1—Planned Project Assessment Findings and Corrective Action Responses (UFP-QAPP Manual Section 4.1.2)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Timeframe for Response
Offsite Laboratory Technical Systems Audit	Written Audit Report	Randy Ward, Empirical Laboratory QA Officer	Within 2 months of audit	Memorandum	NFESC Auditor, TBD	Within 2 months of receipt of initial notification

Note: If corrective action is warranted for a finding not included in a planned assessment, the following corrective action form will be completed and documented in the project file.

SAP Worksheet #32-2—Corrective Action Form Person initiating Corrective Action _______ Date ______ Description of problem and when identified: _______

Cause of problem, if known or suspected:

Sequence of Corrective Action: (including date im	plemented, action planned and
personnel/data affected)	
Corrective Action implemented by:	Date:
Corrective Action initially approved by:	Date:
Follow-up date:	
Final Corrective Action approved by:	Date:

Information copies to:

Anita Dodson, JV 2 Program Chemist

Navy QAO

SAP Worksheet #33—QA Management Reports Table (<u>UFP QAPP Manual Section 4.2</u>)

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
QA Management Report/Technical Memorandum	Once results are received from data validator	December 2009	JV 2, NSN Partnering Team	Will be posted in project file.

SAP Worksheet #34—Verification (Step I) Process Table (<u>UFP-QAPP Manual Section 5.2.1</u>)

Verification Input	Description	Internal / External	Responsible for Verification
Planning Documents	Evidence of approval and completeness of UFP-SAP.	Internal	Jason Chebetar – JV 2 (AGVIQ) Adina Carver – JV 2 (CH2M HIL)
CoC and shipping forms	CoC forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the CoC will be initialed by the reviewer, a copy of the CoC retained in the site file, and the original and remaining copies taped inside the cooler for shipment. See Appendix B, SOP-010 for further details.	Internal	FTL – JV 2 Genevieve Moore – JV 2
Field Log Notebooks	Field notes will be reviewed to ensure completeness of field data parameters, shipping information, sample collection times, etc. The logbook will also be used to document, explain, and justify all deviations from the approved UFP-SAP.	Internal	Jason Chebetar – JV 2 (AGVIQ) Adina Carver – JV 2 (CH2M HIL)
Laboratory Receipt	Upon their arrival at the laboratory, the samples will be cross-referenced against the CoC records. All sample labels will be checked against the CoC, and any mislabeling will be identified, investigated, and corrected. The samples will be logged in at every storage area and work station required by the designated analyses. Individual analysts will verify the completeness and accuracy of the data recorded on the forms.	Internal	Empirical Laboratories employees
QC Summary Report	A summary of all QC sample results will be verified for completeness once the data is received from the laboratory.	External	Genevieve Moore – JV 2
Laboratory Data Package	Once received from the laboratory, the data package will be reviewed for completeness and consistency before the data is loaded or sent to a third party validator.	External	Genevieve Moore – JV 2

SAP Worksheet #35—Validation (Steps IIa and IIb) Process Table

(UFP-QAPP Manual Section 5.2.2) (Figure 37 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
llb	Onsite Screening	Ensure that all field data meet SAP requirements for completeness and accuracy based on the field calibration records.	FTL – JV 2
Ila	SOPs	Ensure that all sampling and analytical SOPs were followed.	FTL – JV 2
			Randy Ward — Empirical QA Officer
Ila	Method QC Results	Ensure that all required QC samples were run and met method and/or project required limits.	Nancy Weaver — Environmental Data Services
IIb	SAP QC Sample Results	Ensure that all required SAP QC samples were run and met required limits.	Megan Hilton — JV 2 Nancy Weaver — Environmental Data Services
IIb	QLs	Ensure all sample results met the project quantification limit specified in the SAP.	Megan Hilton — JV 2
Ila	Raw Data	Ten percent review of raw data to confirm laboratory calculations	Nancy Weaver — Environmental Data Services

Ila=compliance with methods, procedures, and contracts

IIb=comparison with measurement performance criteria in the SAP

SAP Worksheet #36—Analytical Data Validation (Steps IIa and IIb) Summary Table (<u>UFP-QAPP Manual Section 5.2.2.1</u>)

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator
lla	Groundwater	VOCs, Volatile Fatty Acids, Methane, Ethane, Ethene, Nitrate, Nitrite, Sulfate, Sulfide, TOC, Alkalinity	Analytical methods and laboratory SOPs as presented in this SAP will be used to evaluate compliance against QA/QC criteria. Should adherence to QA/QC criteria yield deficiencies, data may be qualified. The data qualifiers that may be used are those presented in Region III Modification to National Functional Guidelines for Organic Data Review, MultiMedia, Multi Concentration (September 1994)	Environmental Data Services
lla	Groundwater	Iron and Manganese	Analytical methods and laboratory SOPs as presented in this SAP will be used to evaluate compliance against QA/QC criteria. Should adherence to QA/QC criteria yield deficiencies, data may be qualified. The data qualifiers that may be used are those presented in Region III Modification to National Functional Guidelines for Evaluating Inorganic Analyses (April 1993)	Environmental Data Services
lla	Aqueous	TCLPV, TCLPS, TCLPP, TCLPH, TCLPM, Total Cyanide and Sulfide, CORR, IGN	Data will be reviewed against the analytical methods for outstanding QA/QC issues and anomalies by the laboratory. Issues will be summarized in the case narrative. CH2M HILL chemist and PM will review the analytical results and case narrative before the data is loaded to ensure no major problems exist.	Empirical Laboratories Megan Hilton – JV 2 Adina Carver – JV 2 (CH2M HILL) Jason Chebetar – JV 2 (AQVIQ)
IIb	Groundwater	VOCs, Volatile Fatty Acids, Methane, Ethane, Ethene, Nitrate, Nitrite, Sulfate, Sulfide, TOC, Alkalinity, Iron, Manganese	Results will be compared to Project Action Limits as specified in Worksheet #15.	Anita Dodson – JV 2
IIb	Aqueous	TCLPV, TCLPS, TCLPP, TCLPH, TCLPM, Total Cyanide and Sulfide, CORR, IGN	Results will be compared to Project Action Limits in Worksheet #15.	Adina Carver – JV 2 (CH2M HILL) Jason Chebetar – JV 2 (AQVIQ)

SAP Worksheet #37—Usability Assessment

(UFP-QAPP Manual Section 5.2.3)

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

- Non-detected site contaminants will be evaluated to ensure that project QLs in Worksheet #15 were achieved. If project QLs were achieved and the verification and validation steps yielded acceptable data, then the data is considered usable.
- During verification and validation steps, data may be qualified as estimated with the
 following qualifiers: J, UJ, K, L, or UL. These qualifiers represent minor QC deficiencies
 which will not affect the usability of the data. When major QC deficiencies are encountered,
 data will be qualified with an R and in most cases is not considered usable for project
 decisions.
- For statistical comparisons non-detect values will be represented by a concentration equal to
 one-half the sample reporting limit. For duplicate sample results, the most conservative
 value will be used for project decisions.
- Analytical data will be checked to ensure the values and any qualifiers are appropriately
 transferred to the electronic database. These checks include comparison of hardcopy data
 and qualifiers to the electronic data deliverable. Once the data has been uploaded into the
 electronic database, another check will be performed to ensure all results were loaded
 accurately.
- Field and laboratory precision will be compared as RPD between the two results.
- Deviations from the SAP will be reviewed to assess whether Corrective Action is warranted and to assess impacts to achievement of project objectives.

Describe the evaluative procedures used to assess overall measurement error associated with the project.

- To assess whether a sufficient quantity of acceptable data are available for decision making, the data will be reconciled with MPC following validation and review of Data Quality Indicator.
- If significant biases are detected with laboratory QA/QC samples it will be evaluated to assess impact on decision making. Low biases will be described in greater detail as they represent a possible inability to detect compounds that may be present at the site.
- If significant deviations are noted between laboratory and field precision the cause will be further evaluated to assess impact on decision making.

Describe the documentation that will be generated during the usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

 Data tables will be produced to reflect detected and non-detected site COPCs and geochemical parameters. Data qualifiers will be reflected in the tables and discussed in the data quality evaluation.

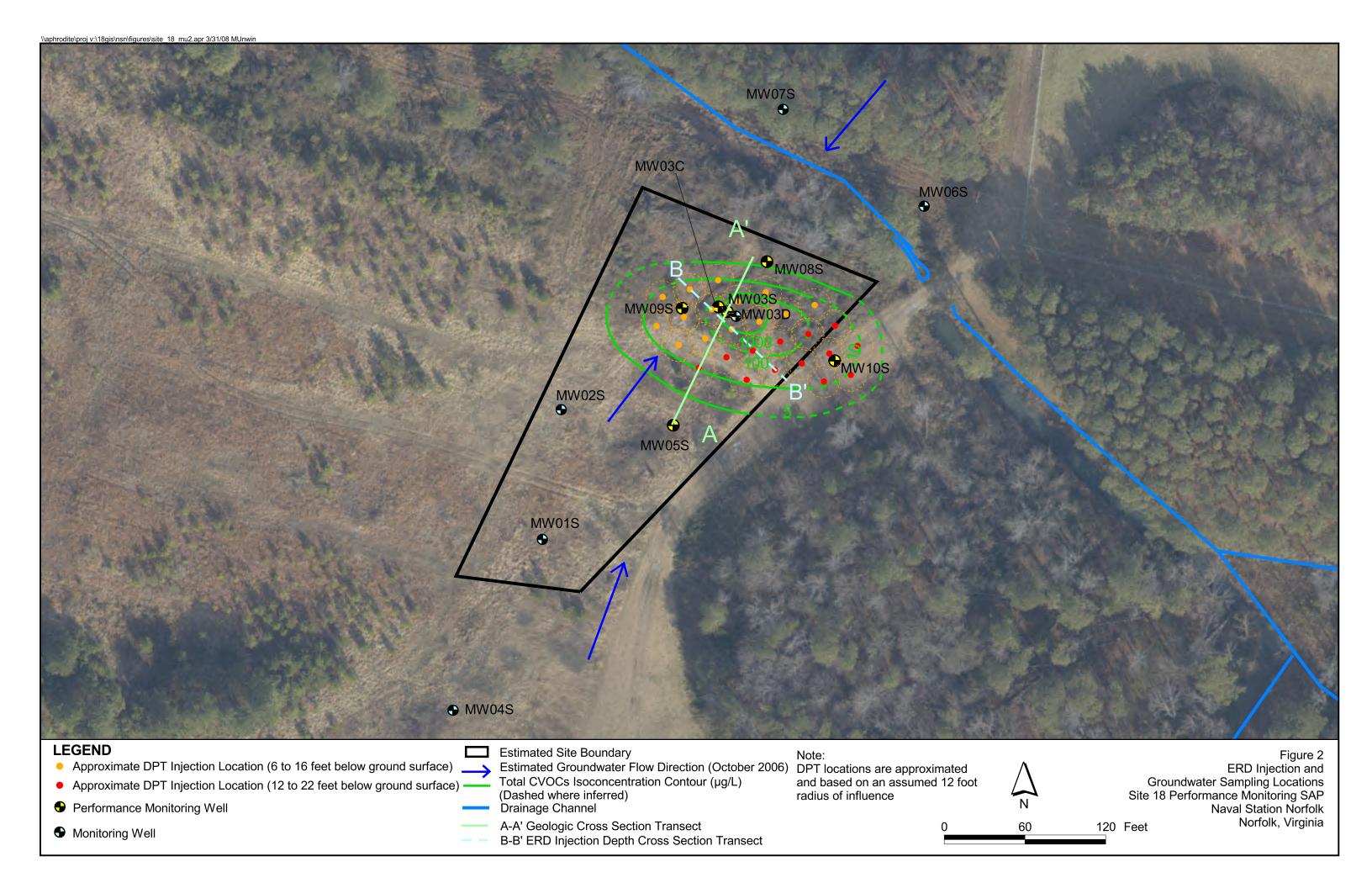
- Graphical representations will be produced to reflect increasing and/or decreasing concentrations of COPCs and geochemical parameters.
- A data quality evaluation will be provided as part of the technical memorandum prepared to assess remedy effectiveness.
- The technical memorandum will identify any data usability limitations and make recommendations for Corrective Action if necessary.

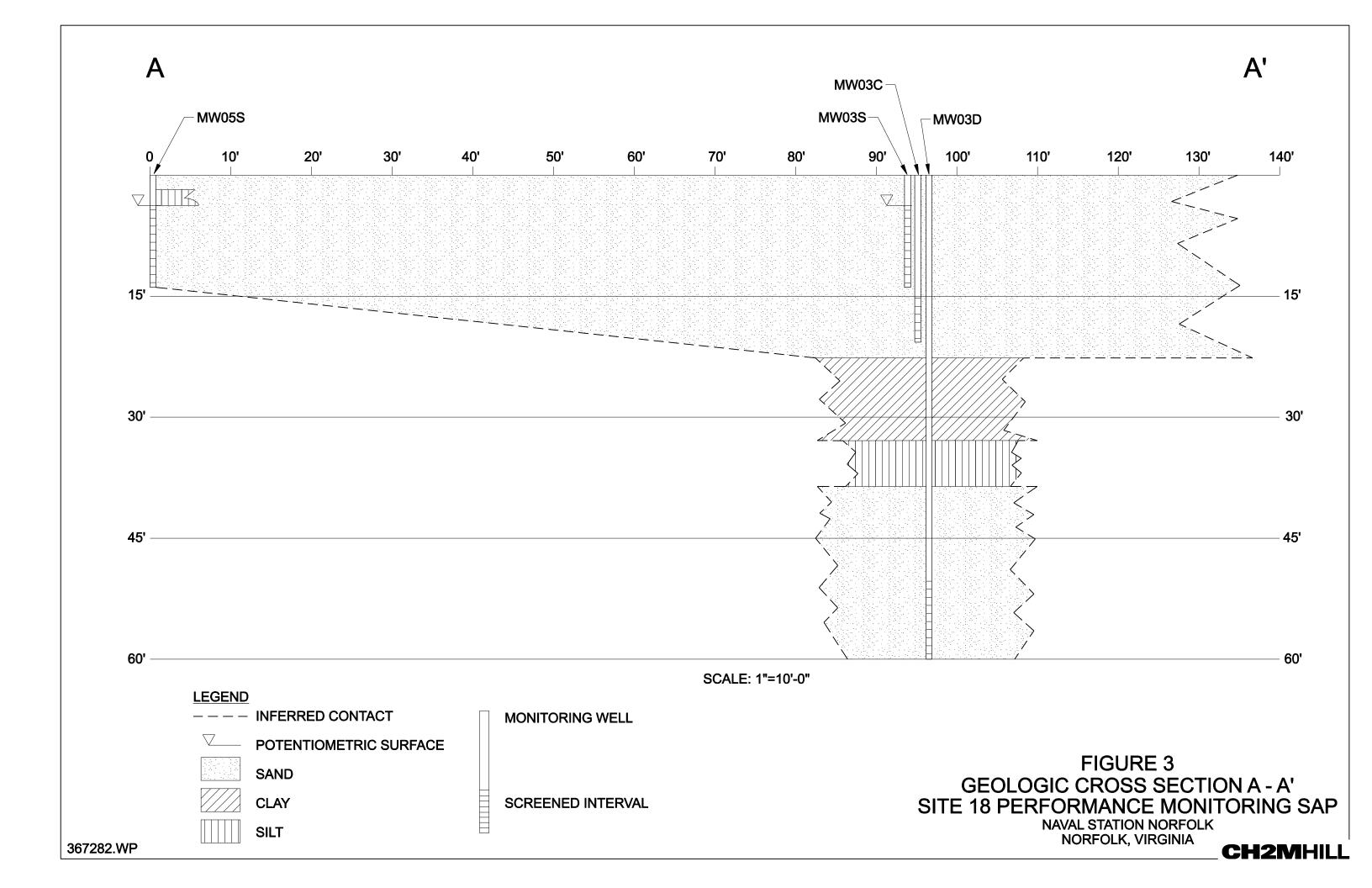
Identify the personnel responsible for performing the usability assessment.

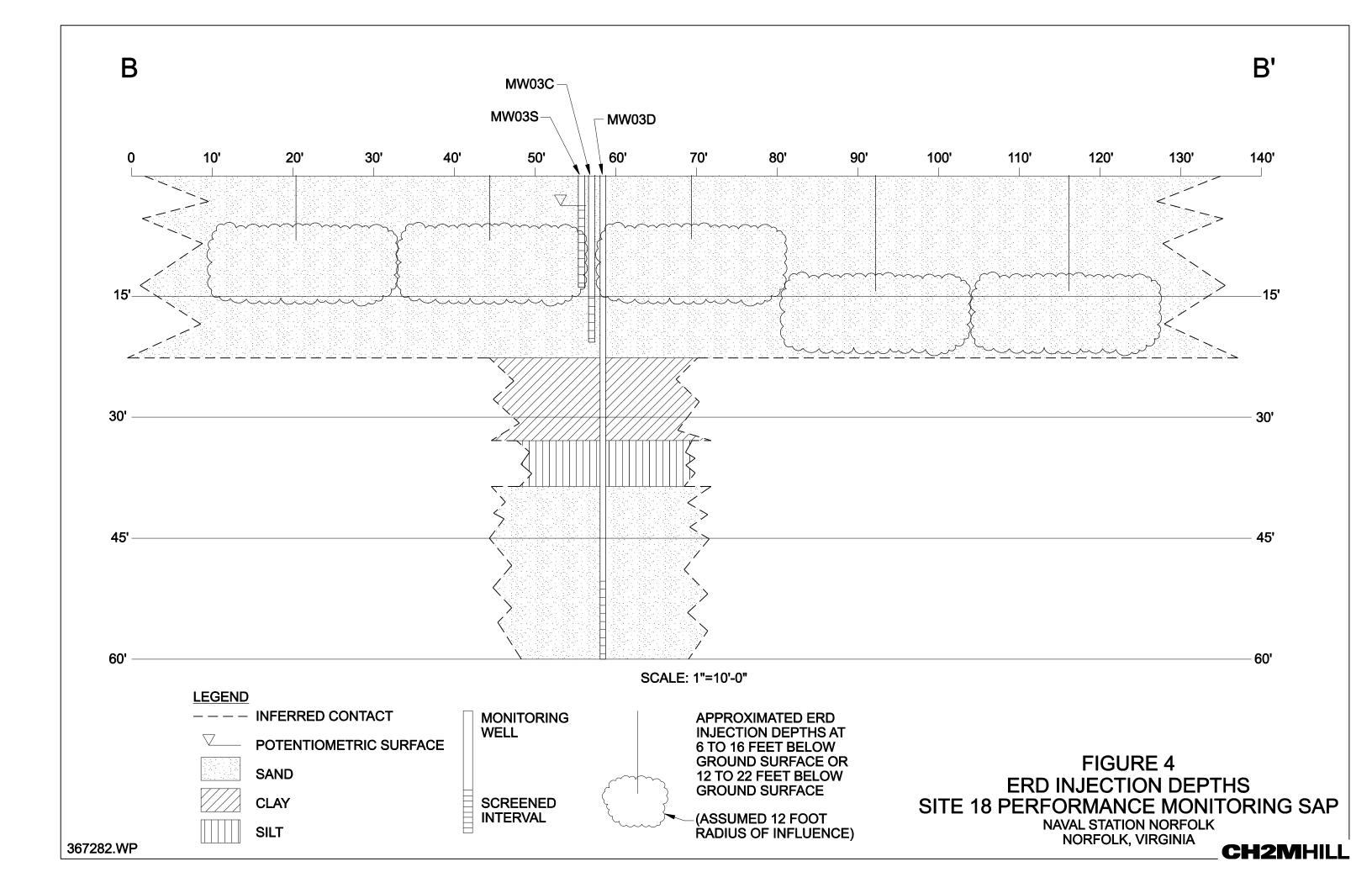
• The PMs, Project Chemist, and other JV 2 team members will be responsible for compiling the data. The data will then be presented to the Partnering Team who, as a whole, will evaluate the data usability according to project objectives.













Appendix A is presented as separate document entitled *Health and Safety Plan, Groundwater Injections at Site 18, Naval Station Norfolk, Norfolk, Virginia* (June, 2008)



Preparing Field Log Books

Purpose

To provide general guidelines for entering field data into log books during site investigation and remediation field activities.

II. Scope

This is a general description of data requirements and format for field log books. Log books are needed to properly document all field activities in support of data evaluation and possible legal activities.

III. Equipment and Materials

- Log book
- Indelible pen

IV. Procedures and Guidelines

Properly completed field log books are a requirement of much of the work we perform. Log books are legal documents and, as such, must be prepared following specific procedures and must contain required information to ensure their integrity and legitimacy. This SOP describes the basic requirements for field log book entries.

A. PROCEDURES FOR COMPLETING FIELD LOG BOOKS

- 1. Field notes commonly are kept in bound, orange-covered logbooks used by surveyors and produced, for example, by Peninsular Publishing Company and Sesco, Inc. Pages should be water-resistant and notes should be taken only with water-proof, non-erasable permanent ink, such as that provided in Sanford Sharpie® permanent markers.
- 2. On the inside cover of the log book the following information should be included:
 - Company name and address
 - Log-holders name if log book was assigned specifically to that person

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Field Books Prepared 5/9/2003 QCed 5/21/03 Reviewed and Revised 01/2008

- Activity or location
- Project name
- Project manager's name
- Phone numbers of the company, supervisors, emergency response, etc.
- 3. All lines of all pages should be used to prevent later additions of text, which could later be questioned. Any line not used should be marked through with a line and initialed and dated. Any pages not used should be marked through with a line, the author's initials, the date, and the note "Intentionally Left Blank."
- 4. If errors are made in the log book, cross a single line through the error and enter the correct information. All corrections shall be initialed and dated by the personnel performing the correction. If possible, all corrections should be made by the individual who made the error.
- 5. Daily entries will be made chronologically.
- 6. Information will be recorded directly in the field log book during the work activity. Information will not be written on a separate sheet and then later transcribed into the log book.
- 7. Each page of the log book will have the date of the work and the note takers initials.
- 8. The final page of each day's notes will include the note-takers signature as well as the date.
- 9. Only information relevant to the subject project will be added to the log book.
- 10. The field notes will be copied and the copies sent to the Project Manager or designee in a timely manner (at least by the end of each week of work being performed).

B. INFORMATION TO BE INCLUDED IN FIELD LOG BOOKS

- 1. Entries into the log book should be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory. Entries must be legible and complete.
- 2. General project information will be recorded at the beginning of each field project. This will include the project title, the project number, and project staff.
- 3. Scope: Describe the general scope of work to be performed each day.
- 4. Weather: Record the weather conditions and any significant changes in the weather during the day.

- 5. Tail Gate Safety Meetings: Record time and location of meeting, who was present, topics discussed, issues/problems/concerns identified, and corrective actions or adjustments made to address concerns/problems, and other pertinent information.
- 6. Standard Health and Safety Procedures: Record level of personal protection being used (e.g., level D PPE), record air monitoring data on a regular basis and note where data were recording (e.g., reading in borehole, reading in breathing zone, etc). Also record other required health and safety procedures as specified in the project specific health and safety plan.
- 7. Instrument Calibration; Record calibration information for each piece of health and safety and field equipment.
- 8. Personnel: Record names of all personnel present during field activities and list their roles and their affiliation. Record when personnel and visitors enter and leave a project site and their level of personal protection.
- 9. Communications: Record communications with project manager, subcontractors, regulators, facility personnel, and others that impact performance of the project.
- 10. Time: Keep a running time log explaining field activities as they occur chronologically throughout the day.
- 11. Deviations from the Work Plan: Record any deviations from the work plan and document why these were required and any communications authorizing these deviations.
- 12. Heath and Safety Incidents: Record any health and safety incidents and immediately report any incidents to the Project Manager.
- 13. Subcontractor Information: Record name of company, record names and roles of subcontractor personnel, list type of equipment being used and general scope of work. List times of starting and stopping work and quantities of consumable equipment used if it is to be billed to the project.
- 14. Problems and Corrective Actions: Clearly describe any problems encountered during the field work and the corrective actions taken to address these problems.
- 15. Technical and Project Information: Describe the details of the work being performed. The technical information recorded will vary significantly between projects. The project work plan will describe the specific activities to be performed and may also list requirements for note taking. Discuss note-taking expectations with the Project Manager prior to beginning the field work.
- 16. Any conditions that might adversely affect the work or any data

- obtained (e.g., nearby construction that might have introduced excessive amounts of dust into the air).
- 17. Sampling Information; Specific information that will be relevant to most sampling jobs includes the following:
 - Description of the general sampling area site name, buildings and streets in the area, etc.
 - Station/Location identifier
 - Description of the sample location estimate location in comparison to two fixed points – draw a diagram in the field log book indicating sample location relative to these fixed points – include distances in feet.
 - Sample matrix and type
 - Sample date and time
 - Sample identifier
 - Draw a box around the sample ID so that it stands out in the field notes
 - Information on how the sample was collected distinguish between "grab," "composite," and "discrete" samples
 - Number and type of sample containers collected
 - Record of any field measurements taken (i.e. pH, turbidity, dissolved oxygen, and temperature, and conductivity)
 - Parameters to be analyzed for, if appropriate
 - Descriptions of soil samples and drilling cuttings can be entered in depth sequence, along with PID readings and other observations. Include any unusual appearances of the samples.

C. SUGGESTED FORMAT FOR RECORDING FIELD DATA

- 1. Use the left side border to record times and the remainder of the page to record information (see attached example).
- 2. Use tables to record sampling information and field data from multiple samples.
- 3. Sketch sampling locations and other pertinent information.
- 4. Sketch well construction diagrams.

D

CMS Operator Guide

This visual presentation is intended to help the user understand the Draeger Chip Measurement System
It is not intended to substitute for any specific instructions



Intended Use

• The Draeger CMS is a hand held on-the-spot detection tool for the measurement of toxic gases and vapors in the workplace. It can be used for exposure measurements, confined space entry, process control, & environmental control.



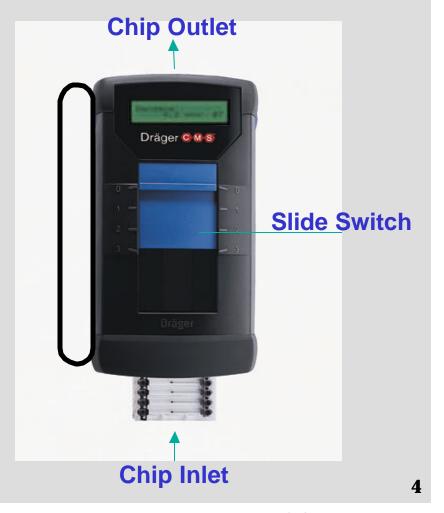
The CMS Chip

- Ten individual tests per CMS Chip
- Two year shelf life, stamped on the box
- Store below 77 °F
 Do Not Freeze
- Safely contains hazardous glass fragments
- Over 50 chips!



The CMS Analyzer

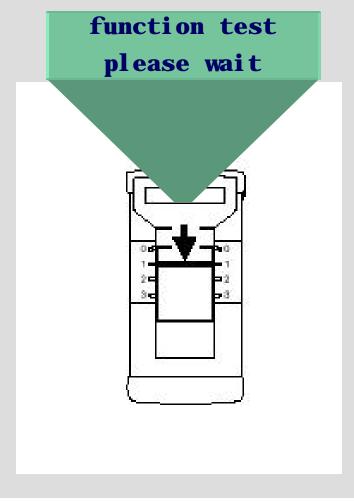
- Slide Switch
- Digital Display
- Operates on 4 "AA" batteries
- No Calibration
- Minimal Training



Turning On the Analyzer

•Slide switch to position 1: Analyzer performs a self-test of electronic functions.

Display elements are activated:



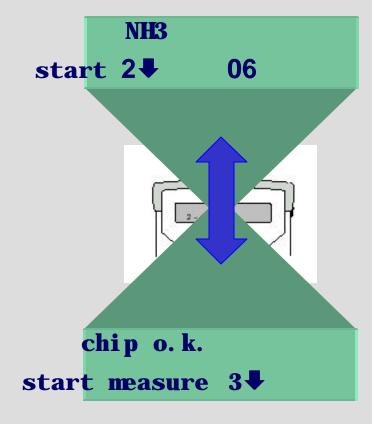
Inserting the Chip

- Make certain the sliding switch is in position 1.
- •WAIT for the "load chip" prompt.
- 1 Insert Chip with arrow pointing toward the analyzer and barcode up, into the Chip inlet as shown in the diagram.
 - Only hold Chip on edges.
- 2 Press Chip in upward direction in order to open the blue chip inlet port.
- 3 Slide Chip evenly and <u>completely</u> into the Chip inlet.



After inserting the Chip

- Slide switch to position 2
 Wait for chip OK
- Slide switch to position 3
 Measurement is conducted
- The result is displayed at the end of the measurement



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Performing a Measurement

•At the end of the measurement, the result is indicated in combination with a beep.

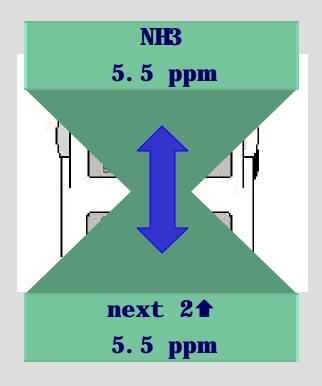
analysis

please wait

Then alternating messages appear in the display:

NH3 5.5 ppm

next 2**1** 5.5 ppm



To take the next measurement return to position 1 and repeat the process



Display Backlighting

Backlight can be switched on in positions 1, 2, or 3.

- •Briefly press the side button: Display illuminated for approx. 5 secs.
- Press side button for 2 secs:
 Display will remain illuminated until the device is switched off.



(

CMS Support

Draeger is happy to assist you with any questions you have on the use of the CMS.

Draeger Safety (USA) toll free @ 800/922-5518

Draeger Canada toll free @ 877/372-4371



Multi RAE Photoionization Detector (PID)

I. Purpose

The purpose of this SOP is to provide general reference information for using the Multi RAE PID in the field. Calibration and operation, along with field maintenance, will be included in this SOP.

II. Scope

This procedure provides information into the field operation and general maintenance of the Multi RAE PID. Review of the information contained herein will ensure that this type of field monitoring equipment will be properly utilized. Review of the owner's instruction manuals is a necessity for more detailed descriptions.

III. Definitions

Carbon Monoxide Sensor (CO) - Expresses the Carbon Monoxide concentration in parts per million (ppm).

Volatile Organic Compound (VOC) – Expresses the VOC concentration in parts per million (ppm)

Lower Explosive Limit (LEL) - Combustible gas is expressed as a percent of the lower explosive limit.

Hydrogen Sulfide Sensor (H₂S) - Expresses the Hydrogen Sulfide concentration in parts per million (ppm).

Oxygen Sensor (OXY) - Expresses the Oxygen concentration as a percentage.

ppm - parts per million: parts of vapor or gas per million parts of air by volume.

IV. Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other approved procedures are developed. The Project Manager is responsible for selecting qualified individuals for the monitoring activities.

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MultiRAE.doc 01/2008 Health and Safety Coordinator - The Health and Safety Coordinator is responsible for developing a site-specific Health and Safety Plan (HASP) which specifies air monitoring requirements.

Field Team Leader - It is the responsibility of the Field Team Leader to implement these procedures in the field, and to ensure that the field team performing air monitoring activities have been briefed and trained to execute these procedures before the start of site operations.

Safety Coordinator-Hazard Worker (SC-HW)- The SC-HW is responsible for ensuring that the specified air monitoring equipment is on site, calibrated, and used correctly by the field personnel. The SC-HW will coordinate these activities with the Field Team Leader if the SC-HW is not the Field Team Leader as well.

Field team - It is the responsibility of the field team to follow these procedures or to follow documented project-specific procedures as directed by the Field Team Leader/ Safety Coordinator-Hazard Worker. The field personnel are responsible for documenting all air monitoring results in the field logbook during each field investigation.

V. Procedures

The Multi RAE utilizes the principle of detecting sensors. The PID operates on the principle that most organic compounds and some inorganic compounds are be ionized when they are bombarded by high-energy ultraviolet light. These compounds absorb the energy of the light, which excites the molecule and results in a loss of electron and the formation of a positively charged ion. The number of ions formed and the ion current produced is directly proportional to mass and concentration. The amount of energy required to displace an electron is called ionization potential (IP). The air sample is drawn into a UV lamp using a pump or a fan. The energy of the lamp determines whether a particular chemical will be ionized. Each chemical compound has a unique ionizing potential. When the UV light energy is greater than the ionization potential of the chemical, ionization will occur. When the sample is ionized, the electrical signal is displayed on an analog or digital output. Although the output does not distinguish between chemicals, it does detect an increase in the ion current. If only one chemical is present in the air, it is possible to use PIDs quantitatively. Chemical structure and lamp intensity affects the sensitivity of the instrument to a given contaminant. All PID readings are relative to the calibration gas, usually isobutylene. It is important to calibrate the PID in the same temperature and elevation that the equipment will be used, and to determine the background concentrations in the field before taking measurements. For environments where background readings are high, factory zero calibration gas should be used.

The following subsections will discuss Multi RAE calibration, operation, and maintenance. These sections, however, do not take the place of the instruction manual.

A. Calibration

For Multi RAE configured with O₂, LEL, H₂S, CO, sensors and a 10.6eV PID Lamp.

Start up Instrument

- Press **Mode** button
- Observe displays:

On!
Multi RAE Version X.XX
Model Number
SN XXXX
Date Time Temp
Checking Sensor Ids
VOC Installed
CO Installed
H₂S Installed
OXY Installed
LEL Installed
H₂S VOC CO LEL OXY
Alarm Limits=
XX XX.X XX XX High XX.X
XX XX.X XX XX Low XX X

XX XX.X XX
STEL

XX XX.X XX
TWA

Battery = X.XV
Shut off at 4.2V

User Mode=

Alarm Mode=

Datalog Time Left

Datalog Mode

Datalog Period

Unit ready in.....
10 Seconds

• The pump will start, the seconds will count down to zero, and the instrument will be ready for use

Calibration Check and Adjustment

Allow instrument to warm up for 15 minutes.

- Depress the [N/-] key first, then while depressing the [N/-], depress the [Mode] key also and depress both keys for 5 seconds.
- Display will read:

Calibrate Monitor?

- Press the [Y/+] key
- Display will read:

Fresh Air Calibration?

- If "Zero Air" is necessary, attach the calibration adapter over the inlet port of the Multi RAE Monitor and connect the other end of the tube to the gas regulator (HAZCO loaner regulator LREG.5, RAE Systems P/N 008-3011 or suitable .5 LPM regulator) on the Zero Air bottle (HAZCO P/N SGZA, RAE P/N 600-0024). If no Zero Air is available, perform the Fresh Air Calibration in an area free of any detectable vapor.
- Press the [Y/+] key

Zero	
In progress	
CO Zeroed!	
Reading = X	
VOC Zeroed! Reading = X	
LEL Zeroed!	
Reading = X	
OXY Zeroed! Reading = X	
Reading - A	
Zero Cal done!	
H ₂ S Zeroed!	
Reading = X	
ach of the above screens,	"X" is equal to the reading of the sensor before it was zeroed
Display will then read:	
Multiple Sensor	
Calibration?	
Press the [Y/+] key	
The display shows all of	the pre-selected sensors and the "OK?" question:
CO H ₂ S	
LEL OK? OXY	
	use either HAZCO Services Part Number R-SGRAE4 or Rae 8-3002 – using a .5 LPM regulator and direct tubing.
Press the [Y/+] key. Disp	lay will read:
Apply Mixed gas	
G 17	
Calibration	
In progress	
	own showing the number of remaining seconds:
CO cal'ed	
Reading=50	
_	
H ₂ S cal'ed	
Reading=25	I

LEL cal'ed
Reading=50

OXY cal'ed
Reading=20.9

Calibration done
Turn off gas!

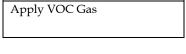
• Display will read:

Single Sensor Calibration?

- Press the [Y/+].
- Display will read:

CO VOC H₂S LEL pick? OXY

- Attach 100 ppm Isobutylene (HAZCO P/N r-SGISO or Rae P/N 600-0002) using a 1.0 LPM regulator (HAZCO P/N LR10HS or Rae P/N 008-3021). Open regulator.
- Press the [Mode] key once, the V of VOC will be highlighted.
- Press the [Y/+]. The display will read:



Calibration
In progress...

• The display will count down showing the number of remaining seconds:, then display:

VOC cal'd Reading=100

Calibration done Turn off gas!

Single Sensor
Calibration?

- Press [Mode] key twice to return to main screen.
- CALIBRATION IS COMPLETE!

B. Operation

Due to the Multi RAE having many functions in terms of operation, it is recommended that you follow the operational procedures as outlined in the instruction manual from pages 9 to 14.

C. Site Maintenance

After each use, the meter should be recharged and the outside of the instruments should be wiped clean with a soft cloth.

D. Scheduled Maintenance

<u>Function</u> <u>Frequency</u>

Check alarm and settings Monthly/before each use

Clean screens and gaskets around sensors Monthly

Replace sensors Biannually or when calibration is

unsuccessful

VI. Quality Assurance Records

Quality assurance records will be maintained for each air monitoring event. The following information shall be recorded in the field logbook.

- Identification Site name, date, location, CTO number, activity monitored, (surface water sampling, soil sampling, etc), serial number, time, resulting concentration, comments and identity of air monitoring personnel.
- Field observations Appearance of sampled media (if definable).
- Additional remarks (e.g, Multi RAE had wide range fluctuations during air monitoring activities.)

VII. References

Multi RAE Plus Multiple Gas Monitor User Manual, RAE Systems, Revision B1, November 2003.

Water-Level Measurements

I. Purpose and Scope

The purpose of this procedure is to provide a guideline for the measurement of the depth to groundwater in piezometers and monitoring wells, even where a second phase of floating liquid (e.g., gasoline) is encountered, and on staff gages in surfacewater bodies. This SOP includes guidelines for discrete measurements of static water levels and does not cover the use of continuously recording loggers (see SOP *Use of Data Loggers and Pressure Transducers*).

II. Equipment and Materials

- Electronic water-level meter (Solinst® or equivalent) with a minimum 100-foot tape; the tape should have graduations in increments of 0.01 feet or less
- Interface probe (Solinst® Model 122 Interface Meter or equivalent)

III. Procedures and Guidelines

Verify that the unit is turned on and functioning properly. Slowly lower the probe on its cable into the piezometer or well until the probe just contacts the water surface; the unit will respond with a tone or light signal. Note the depth from a reference point indicated on the piezometer or well riser. Typically this is the top of the protective casing. If no reference is clearly visible, measure the depth to water from the northern edge of the riser. If access to the top of the riser is difficult, sight across the top of the locking casing adjacent to the measuring point, recording the position of the cable when the probe is at the water surface.

Measure the distance from this point to the closest interval marker on the tape, and record the water level reading in the logbook. Water levels will be measured to the nearest 0.01-foot. Also measure and record the three following readings: (1) the depth of the piezometer or well; (2) the distance from the reference point to the top of the protective casing; and (3) the distance to the surface of the concrete pad or to ground. The depth of the piezometer or well may be measured using the water-level probe with the instrument turned off.

Free product light or dense nonaqueous phase liquid may be present in the piezometer or well. If the presence of free product is suspected, the thickness of the product should be determined using appropriate equipment (e.g., Solinst® Model 122 Interface Meter). The depth to water also is determined with this equipment and the water-level meter should not be used in the piezometer or well as long as product is present. Typically, a

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WaterLevels.doc QCed and revised 1/11/99 QCed and revised 5/19/03 Reviewed 01/2008 constant sound is emitted from the device when free product is encountered and an alternating on/off beep sound is emitted when water is encountered.

The apparent elevation of the water level in the well or piezometer is determined by measuring both the apparent depth to water and the thickness of free product. The corrected water-level elevation is calculated by the following equation:

 $WL_c = Wl_a + (Free-product thickness \times 0.80)$

Where WL_c = Corrected water-level elevation

 Wl_a = Apparent water-level elevation

0.80 = Typical value for the density of petroleum hydrocarbon products.

If free product is detected on the surface of the water in the piezometer or well, the value of sampling should be reconsidered because of the potential for contaminating the sampling equipment.

Staff gages may be installed in some surface-water bodies. These facilities typically are constructed by attaching a calibrated, marked staff gage to a wood or metal post, driving the post into the bottom of the surface-water body, and surveying the elevation of the top of the post to a resolution or 0.01-foot. The elevation of the water in the surface-water body then can be determined by reading off the distance the water level is from the top of the post. A shield or other protection may be needed to calm the fluctuations in water level if the gage is installed at a location exposed to wind or wave.

IV. Attachments

None.

V. Key Checks

- Before each use, verify that the battery is charged by pressing the test button on the water-level meter.
- Verify that the unit is operating correctly by testing the probe in distilled or deionized water. Leave the unit turned off when not in use.

STANDARD OPERATING PROCEDURE

Low-Flow Groundwater Sampling from Monitoring Wells

I. Purpose and Scope

This procedure presents general guidelines for the collection of groundwater samples from monitoring wells using low-flow purging and sampling procedures. Operations manuals should be consulted for specific calibration and operating procedures.

II. Equipment and Materials

- Flow-through cell with inlet/outlet ports for purged groundwater and watertight ports for each probe
- Meters to monitor pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature (e.g., Horiba® U-22 or similar)
- Water-level indicator
- In-line disposable 0.45μm filters (QED® FF8100 or equivalent)
- Adjustable-rate positive-displacement pump, submersible pump, or peristaltic pump
- Generator
- Disposable polyethylene tubing
- Plastic sheeting
- Well-construction information
- Calibrated bucket or other container and watch with second indicator to determine flow rate
- Sample containers
- Shipping supplies (labels, coolers, and ice)
- Field book

III. Procedures and Guidelines

A. Setup and Purging

- 1. For the well to be sampled, information is obtained on well location, diameter(s), depth, and screened interval(s), and the method for disposal of purged water.
- 2. Instruments are calibrated according to manufacturer's instructions.

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- 3. The well number, site, date, and condition are recorded in the field logbook.
- 4. Plastic sheeting is placed on the ground, and the well is unlocked and opened. All decontaminated equipment to be used in sampling will be placed only on the plastic sheeting until after the sampling has been completed. To avoid cross-contamination, do not let any downhole equipment touch the ground.
- 5. All sampling equipment and any other equipment to be placed in the well is cleaned and decontaminated before sampling in accordance with SOP *Decontamination of Personnel and Equipment*.
- 6. Water level measurements are collected in accordance with SOP *Water Level Measurements*. **Do not measure the depth to the bottom of the well at this time**; this reduces the possibility that any accumulated sediment in the well will be disturbed. Obtain depth to bottom information from well installation log.
- 7. Attach and secure the polyethylene tubing to the low-flow pump. Lower the pump slowly into the well and set it at approximately the middle of the screen. Place the pump intake at least 2 feet above the bottom of the well to avoid mobilization of any sediment present in the bottom. Preferably, the pump should be in the middle of the screen.
- 8. Insert the measurement probes into the flow-through cell. The purged groundwater is directed through the cell, allowing measurements to be collected before the water contacts the atmosphere.
- 9. Start purging the well at 0.2 to 0.5 liters per minute. Avoid surging. Purging rates for more transmissive formations could be started at 0.5-liter to 1 liter per minute. The initial field parameters of pH, specific conductance, dissolved oxygen, ORP, turbidity, and temperature of water are measured and recorded in the field logbook.
- 10. The water level should be monitored during purging, and, ideally, the purge rate should equal the well recharge rate so that there is little or no drawdown in the well (i.e., less than 0.5-foot). The water level should stabilize for the specific purge rate. There should be at least 1 foot of water over the pump intake so there is no risk of the pump suction being broken, or entrainment of air in the sample. Record adjustments in the purge rate and changes in depth to water in the logbook. Purge rates should, if needed, be decreased to the minimum capabilities of the pump (0.1- to 0.2-liter per minute) to avoid affecting well drawdown.
- 11. During purging, the field parameters are measured frequently (every 3 to 5 minutes) until the parameters have stabilized. Field parameters are considered stabilized when measurements meet the following criteria:
 - pH: within 0.1 pH units

- Specific conductance: within 3 percent
- Dissolved oxygen: within 10 percent
- Turbidity: within 10 percent or as low as practicable given sampling conditions
- ORP: within 10 mV

B. Sample Collection

Once purging has been completed, the well is ready to be sampled. The elapsed time between completion of purging and collection of the groundwater sample from the well should be minimized. Typically, the sample is collected immediately after the well has been purged, but this is also dependent on well recovery.

Samples will be placed in bottles that are appropriate to the respective analysis and that have been cleaned to laboratory standards. Each bottle typically will have been previously prepared with the appropriate preservative, if any.

The following information, at a minimum, will be recorded in the logbook:

- 1. Sample identification (site name, location, and project number; sample name/number and location; sample type and matrix; whether the sample is filtered or not; time and date; sampler's identity)
- 2. Sample source and source description
- 3. Field observations and measurements (appearance, volatile screening, field chemistry, sampling method), volume of water purged prior to sampling, number of well volumes purged, and field parameter measurements
- 4. Sample disposition (preservatives added; laboratory sent to, date and time sent; laboratory sample number, chain-of-custody number, sample bottle lot number)

The steps to be followed for sample collection are as follows:

- 1. The cap is removed from the sample bottle, and the bottle is tilted slightly.
- 2. The sample is slowly discharged from the pump so that it runs down the inside of the sample bottle with a minimum of splashing. The pumping rate should be reduced to approximately 100 ml per minute when sampling VOCs.
- 3. Samples may be field filtered before transfer to the sample bottle. Filtration must occur in the field immediately upon collection. Inorganics, including metals, are to be collected and preserved in the filtered form as well as the unfiltered form. The recommended method is through the use of a disposable in-line filtration module (0.45-micron

- filter) using the pressure provided by the pumping device for its operation.
- 4. Samples for analysis for volatile organic compounds should be collected first, if such samples are required.
- 5. Adequate space is left in the bottle to allow for expansion, except for VOC vials, which are filled to overflowing and capped.
- 6. The bottle is capped, then labeled clearly and carefully following the procedures in SOP *Packaging and Shipping Procedures*.
- 7. Samples are placed in appropriate containers and, if necessary, packed with ice in coolers as soon as practical.

C. Additional remarks

- 1. If the well goes dry during purging, wait until it recovers sufficiently to remove the required volumes to sample all parameters. It may be necessary to return periodically to the well but a particular sample (e.g., large amber bottles for semivolatile analysis) should be filled at one time rather than over the course of two or more visits to the well.
- 2. It may not be possible to prevent drawdown in the well if the water-bearing unit has sufficiently low permeability. If the water level was in the screen to start with, do not worry about it because there is no stagnant water in the riser above the screen to begin with.

If the water level in the well is in the riser above the screen at the beginning of purging, then be sure you pump out sufficient volume from the well to remove the volume of water in the riser above the screen. For a 2-inch diameter well, each foot of riser contains 0.163 gallons; for a 4-inch riser, each foot of riser contains 0.653 gallons; for a 6-inch riser, each foot of riser contains 1.47 gallons.

Alternatively, the water in the riser above the screen can be removed by lowering the pump into the well until the pump intake is just below the water level, starting the pump, running it at a low rate, and slowly lowering the pump as the water level in the riser declines. This approach can be terminated when the water level reaches the top of the screen, at which time the stagnant water in the riser has been removed. This may not be a practical approach for dedicated sampling equipment. As with typical low-flow sampling, the flow rate should be kept as low as practicable.

3. There may be circumstances where a positive-displacement or submersible pump cannot be used. An example is at isolated, hard-to-reach locations where the required power supply cannot be brought. In this case, a peristaltic pump may be used. Samples can be collected by the procedures described above for all but those for VOC analysis. The water to be placed in the vials for VOC analysis should not be run

through the peristaltic pump but instead should be collected by the following:

- Stop the pump when it is time to collect the VOC sample.
- Disconnect the tubing upstream from the pump (a connector must be installed in the line to do this).
- Pinching the tubing to keep the water in the tubing, remove the tubing from the well. Be sure that the tubing does not contact other than clean surfaces.
- Place the end of the tubing that was in the well into each VOC vial and fill the vial by removing the finger from the other end of the tube.
- Once the vials are filled, return the tubing to the well and collect any other samples required.
- 4. Nondedicated sampling equipment is removed from the well, cleaned, and decontaminated in accordance with SOP *Decontamination of Personnel and Equipment*. Disposable polyethylene tubing is disposed of with PPE and other site trash.

IV. Attachments

White paper on reasons and rationale for low-flow sampling.

V. Key Checks and Preventative Maintenance

- The drawdown in the well should be minimized as much as possible (preferably no more than 0.5-foot to 1 foot) so that natural groundwater-flow conditions are maintained as closely as possible.
- The highest purging rate should not exceed 1 liter per minute. This is to keep the drawdown minimized.
- Stirring up of sediment in the well should be avoided so that turbidity containing adsorbed chemicals is not suspended in the well and taken in by the pump.
- Overheating of the pump should be avoided to minimize the potential for losing VOCs through volatilization.
- Keep the working space clean with plastic sheeting and good housekeeping.
- Maintain field equipment in accordance with the manufacturer's recommendations. This will include, but is not limited to:
 - Inspect sampling pump regularly and replace as warranted

- Inspect quick-connects regularly and replace as warranted
- Verify battery charge, calibration, and proper working order of field measurement equipment prior to initial mobilization and daily during field efforts

Attachment to the SOP on Low-Flow Sampling Groundwater Sampling from Monitoring Wells

White Paper on Low-Flow Sampling

EPA recommends low-flow sampling as a means of collecting groundwater samples in a way that minimizes the disturbance to the natural groundwater flow system and minimizes the introduction of contamination into the samples from extraneous sources. The following are details about these issues.

When a pump removes groundwater from the well at the same rate that groundwater enters the well through the screen, the natural groundwater-flow system around the well experiences a minimum of disturbance. Some disturbance is bound to occur because you are causing groundwater to flow to the well in a radial fashion that otherwise would have flowed past it. However, the resulting low-flow sample provides the most-representative indication we can get of groundwater quality in the immediate vicinity of the well.

Normally, when a well is pumped at an excessive rate that drops the water level in the well below the water level in the aquifer, the water cascades down the inside of the well screen when it enters the well. The turbulence from this cascading causes gases such as oxygen and carbon dioxide to mix with the water in concentrations that are not representative of the native groundwater and are higher than expected. This causes geochemical changes in the nature of the water that can change the concentrations of some analytes, particularly metals, in the groundwater sample, not mention its effect on the dissolved oxygen levels that then will be measured in the flow-through cell. Such turbulence also may cause lower-than-expected concentrations of volatile organic compounds due to volatilization.

For wells in which the water level is above the top of the screen, the water up in the riser is out of the natural circulation of the groundwater and, therefore, can become stagnant. This stagnant water is no longer representative of natural groundwater quality because its pH, dissolved-oxygen content, and other geochemical characteristics change as it contacts the air in the riser. If we minimize the drawdown in the well when we pump, then we minimize the amount of this stagnant water that is brought down into the well screen and potentially into the pump. As a result, a more-representative sample is obtained.

Typically, wells contain some sediment in the bottom of the well, either as a residue from development that has settled out of the water column or that has sifted through the sand pack and screen since the well was installed. This sediment commonly has adsorbed on it such analytes as metals, SVOCs, and dioxins that normally would not be dissolved in the groundwater. If these sediments are picked up in the groundwater when the well is disturbed by excessive pumping, they can:

- Make filtering the samples for metals analysis more difficult
- Add unreasonably to the measured concentration of SVOCs and other organic compounds

The SOP for low-flow sampling has been modified recently and should be consulted for additional information about low-flow sampling and ways of dealing with wells in which the water level cannot be maintained at a constant level.

Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature Using the Horiba® U-22 with Flowthrough Cell

I. Purpose and Scope

The purpose of this procedure is to provide a general guideline for using the Horiba® U-22 for field measurements of pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature of groundwater samples. The operator's manual should be consulted for detailed operating procedures.

II. Equipment and Materials

- Horiba® U-22 Water Quality Checker with flow-though cell
- Distilled water in squirt bottle
- Horiba® U-22 Auto-Calibration Standard Solution

III. Procedures and Guidelines

A. Parameters and Specifications:

Parameter	Range of measurement	Accuracy
pН	0 to 14 pH units	+/- 0.1 pH units
Specific	0 to 9.99 S/m	+/-3 % full scale
conductance Turbidity Dissolved	0 to 800 NTU 0 to 19.99 mg/l	+/- 5 % full scale +/- 0.2 mg/l
oxvgen Temperature ORP Salinity	0 to 55 ∘C -999 to +999 mV 0 to 4 %	+/- 1.0 °C +/- 15 mV +/- 0.3 %

B. Calibration:

Prior to each day's use, clean the probe and flow-through cell using deionized water

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QC and revised 1/23/03 QC Review 7/25/07 QC Review 01/2008 and calibrate using Horiba® Standard Solution. Calibration procedure:

- 1. Fill the calibration beaker to about 2/3 with the pH 4 standard solution.
- 2. Fit the probe into the beaker. All the parameter sensors will now be immersed in the standard solution except the D.O. sensor; the D.O. calibration is done using atmospheric air.
- 3. Turn power on.
- 4. Press CAL key to put the unit in the calibration mode.
- 5. Press the ENT key to start automatic calibration. Wait a moment, and the upper cursor will gradually move across the four auto-calibration parameters one by one: pH, COND, TURB, and DO. When the calibration is complete, the readout will briefly show END. The instrument is now calibrated.
- 6. If the unit is calibrated properly, pH will read 4.0 + /-3%, conductivity will read 4.49 + /-3%, and turbidity will read 0 + /-3%

C. Sample Measurement:

As water passes through the flow-through Cell, press MEAS to obtain reading; record in the field notebook.

IV. Key Checks and Preventive Maintenance

- Calibrate meter
- Clean probe with deionized water when done
- Refer to operations manual for recommended maintenance
- Check batteries, and have a replacement set on hand
- Due to the importance of obtaining these parameters, the field team should have a spare unit readily available in case of an equipment malfunction.

VOC Sampling--Water

I. Purpose

To provide general guidelines for sampling aqueous volatile organic compounds.

II. Scope

Standard techniques for collecting representative samples are summarized. Sitespecific details are discussed in the Field Sampling Plan.

III. Equipment and Materials

- Sample vials pre-preserved at laboratory with Hydrochloric acid (HCl)
- Surgical or latex gloves

IV. Procedures and Guidelines

- 1. Sample VOCs before sampling other analyte groups.
- 2. When sampling for VOCs, especially residential wells, evaluate the area around the sampling point for possible sources of air contamination by VOCs. Products that may give off VOCs and possibly contaminate a sample include perfumes and cosmetics, skin applied pharmaceuticals, automotive products (gasoline, starting fluid, windshield deicers, carburetor cleaners, etc.) and household paint products (paint strippers, thinners, turpentine, etc.).
- 3. Keep the caps off the sample vials for as short a time as possible.
- 4. Wear clean latex or surgical gloves.
- 5. Fill the sample vial immediately, allowing the water stream to strike the inner wall of the vial to minimize formation of air bubbles. DO NOT RINSE THE SAMPLE VIALS BEFORE FILLING.

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- 6. Fill the sample vial with a minimum of turbulence, until the water forms a positive meniscus at the brim.
- 7. Replace the cap by gently setting it on the water meniscus. Tighten firmly, but DO NOT OVERTIGHTEN.
- 8. Invert the vial and tap it lightly. If you see air bubbles in the sample, do not add more sample. Use another vial to collect another sample. Repeat if necessary until you obtain a proper sample.

V. Attachments

None.

VI. Key Checks and Items

- Check for possible sources of contamination.
- Fill slowly, with as little turbulence as possible.
- Check for air bubbles.

Equipment Blank and Field Blank Preparation

I. Purpose

To prepare blanks to determine whether decontamination procedures are adequate and whether any cross-contamination is occurring during sampling due to contaminated air and dust.

II. Scope

The general protocols for preparing the blanks are outlined. The actual equipment to be rinsed will depend on the requirements of the specific sampling procedure.

III. Equipment and Materials

- Blank liquid (use ASTM Type II or lab grade water)
- Millipore™ deionized water
- Sample bottles as appropriate
- Gloves
- Preservatives as appropriate

IV. Procedures and Guidelines

- A. Decontaminate all sampling equipment that has come in contact with sample according to SOP *Decontamination of Personnel and Equipment*.
- B. To collect an equipment blank for volatile analysis from the surfaces of sampling equipment other than pumps, pour blank water over one piece of equipment and into two 40-ml vials until there is a positive meniscus, then seal the vials. Note the sample number and associated piece of equipment in the field notebook as well as the type and lot number of the water used.

For non-volatiles analyses, one aliquot is to be used for equipment. For example, if a pan and trowel are used, place trowel in pan and pour blank fluid in pan such that pan and trowel surfaces which contacted the sample are contacted by the blank fluid. Pour blank fluid from pan into appropriate sample bottles.

Do not let the blank fluid come in contact with any equipment that has not been decontaminated.

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- C. When collecting an equipment blank from a pump, run an extra gallon of deionized water through the pump while collecting the pump outflow into appropriate containers. Make sure the flow rate is low when sampling VOCs. If a Grundfos Redi-Flo2 pump with disposable tubing is used, remove the disposable tubing after sampling but before decon. When decon is complete, put a 3- to 5-foot segment of new tubing onto the pump to collect the equipment blank.
- D. To collect a field blank, slowly pour ASTM Type II or lab grade water directly into sample containers.
- E. Document and ship samples in accordance with the procedures for other samples.
- F. Collect next field sample.

V. Attachments

None.

VI. Key Checks and Items

- Wear gloves.
- Do not use any non-decontaminated equipment to prepare blank.
- Use ASTM-Type II or lab grade water.

Sampling Contents of Tanks And Drums

I. Scope and Application

This procedure provides an overview approach and guidelines for the routine sampling of drums and tanks. Its purpose is to describe standard procedures and precautions which are applied in sampling drums and tanks. Procedures for opening drums with the individual instruments are included in Attachment D.

The samples obtained may be used to obtain physical chemical or radiological data. The resulting data may be qualitative or quantitative in nature, and are appropriate for use in preliminary surveys as well as confirmatory sampling.

II. References

- A. A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001, U.S. Environmental Protection Agency, Washington, D.C., 1987.
- B. Data Quality Objectives for Remedial Activities Development Process, EPA/540/G-87/003, U.S. Environmental Protection Agency, Washington, D.C., 1987.
- C. Annual Book of ASTM Standards, Standard Recommended Practices for Sampling Industrial Chemicals, ASTM-E-300, 1986.
- D. Test Method for Evaluating Solid Waste, SW-846, Volume II, Field Methods, Second Edition, U.S. Environmental Protection Agency, Washington, D.C., 1982.
- E. U.S. Environmental Protection Agency, *Characterization of Hazardous Waste Sites A Method Manual: Volume II, Available Sampling Methods*, USEPA Environmental Monitoring Systems Laboratory, Las Vegas, EPA-600/4-84-076, December, 1984.
- F. Environmental Surveillance Procedures, Quality Control Program, Martin Marietta Energy Systems, ESH/Sub/87-21706/1, Oak Ridge, TN, September 1988.

III. Summary of Methods

Drums are generally sampled by means of sampling tubes such as glass sample tubes or COLIWASA samplers. In either case, the sampling tube is manually inserted into the waste

material. A sample of the drum contents is withdrawn by the sampling device. Should a drum contain bottom sludge, a glass tube will retrieve a sample of this as well.

Storage tank and tank trailers, because of their greater depths, require sampling devices that can be lowered from the top, filled at a particular depth, then withdrawn. Such devices are a COLIWASA, a Kemmerer depth sampler, or a Bacon Bomb. Where samples of bottom sludge are desired, a gravity corer can be utilized. This heavy tube with a tapered nose piece will penetrate the sludge as it free falls through the tank.

IV. Comments

The sampling of tanks, containers, and drums present unique problems not associated with environmental samples. Containers of this sort are generally closed except for small access ports, manways, or hatches on the larger vessels, or taps and bungs on smaller drums. The physical size, shape, construction material, and location of access limit the types of equipment and methods of collection that can be used.

When liquids are contained in sealed vessels, gas vapor pressure can build up, sludges can settle out, and density layerings (stratification) can develop. Bulging drums may be under pressure and extreme caution should be exercised. The potential exists for explosive reactions or the release of noxious gases when containers are opened. All vessels should be opened with extreme caution. Check the HSP for the level of personnel protection to be worn. A preliminary sampling of any headspace gases is warranted. As a minimum, a preliminary check with an explosimeter and an organic vapor analyzer may be of aid in selecting a sampling method.

In most cases it is impossible to observe the contents of these sealed or partially sealed vessels. Since some layering or stratification is likely in any solution left undisturbed over time, a sample must be taken that represents the entire depth of the vessel.

V. Required Equipment and Apparatus

- A. **Health and safety equipment/materials**: As listed in the site safety plan.
- B. **Sampling equipment**: COLIWASA, glass sample tubes, Kemmerer depth sampler, Bacon Bomb, gravity corer.
- C. **Tools**: Rubber mallet, bung wrench, speed wrench with socket, etc., (all non-sparking), paint marker.
- D. **Heavy equipment**: Backhoe equipped with explosion shield, drum grappler, and 3-foot copper-beryllium (non-sparking) spike with 6-inch collar (to puncture top of drums for sampling, if necessary).
- E. **Sample Containers**: As specified in the field sampling plan.

VI. Procedures

A. Drums

NOTE: DO NOT open more than one drum at a time. Each drum must be handled and sampled as a separate entity to reduce vapors in the sampling area.

- 1. Drums will be sampled on an area-by-area basis. Drums will be sampled after they have been placed in overpack drums but before they are transferred from the excavation to the onsite storage area.
- 2. Record, in logbook, all pertinent information from visual inspection of drum (e.g., physical condition, leaks, bulges, and labels). Label each drum with a unique identifying number.
- 3. If possible, stage drums for easy access.
- 4. If necessary, attach ground strap to drums and grounding point.
- 5. Remove any standing material (water, etc.) from container top.
- 6. Using non-sparking tools, carefully remove the bung or lid while monitoring air quality with appropriate instruments. If necessary (and as a last resort), the non-sparking spike affixed to the backhoe can also be used to puncture the drum for sampling. See Attachment D for method of drum opening. Record air-quality monitoring results.
- 7. When sampling a previously sealed vessel, a check should be made for the presence of bottom sludge. This is accomplished by measuring the depth to apparent bottom, then comparing it to the known interior depth.
- 8. Agitation to disrupt the layers and rehomogenize the sample is physically difficult and almost always undesirable. If the vessel is greater than 3 feet in depth (say, a 55-gallon drum), the appropriate sampling method is to slowly lower the sampling device (i.e., suction line of peristaltic pump, glass tube) in known increments of length. Discrete samples can be collected from various depths, then combined or analyzed separately. If the depth of the vessel is greater than the lift capacity of the pump, an at-depth water sampler, such as the Kemmerer or Bacon Bomb type, may be required.
- 9. Extract a representative sample from the drum using a glass rod, COLIWASA, Bacon Bomb, Kemmerer bottle, or gravity corer (See Attachments). Ensure that the entire depth of material is penetrated. Depending on the size of the opening of the drum, three to four takes should be collected from random locations across the drum surface, to ensure a representative sample. Any observed stratification must be

- recorded in logbook, including number and thickness of the layers and a conceptualized sketch.
- 10. Record a visual description of the sample (e.g., liquid, solid, color, viscosity, and percent layers).
- 11. When possible, sampling equipment (like glass tubes) should be expendable and be left inside the drum for disposal with drum contents, once sampling is completed.
- 12. Place lid, bung, cap, etc., back in place on drum. Tighten hand tight. If necessary, the sampling port can be sealed using a cork.
- 13. Wipe up spilled material with lab wipes. Wipe off sample containers.
- 14. Mark the drum with a unique sample identification number and date using a paint marker.
- 15. Samples will be handled as high hazard samples. Samples will be placed in containers defined according to the analytical needs, wiped clean, and then packed in paint cans for shipping. Packaging, labeling, and preparation for shipment procedures will follow procedures as specified in the field sampling plan.

B. Underground Storage Tanks

- 1. A sampling team of at least two people is required for sampling—one will collect samples, the other will relay required equipment and implements.
- 2. Sampling team will locate a sampling port on the tank. Personnel should be wearing appropriate protective clothing at this time and carrying sampling gear.
- 3. Do not attempt to climb down into tank. Sampling MUST BE accomplished from the top.
- 4. Collect a sample from the upper, middle, and lower section of the tank contents with one of the recommended sampling devices.
- 5. If compositing is necessary, ship samples to laboratory in separate containers for laboratory compositing.
- 6. Samples will be handled as hazardous. Samples will be placed in appropriate containers and packed with ice in a cooler. Packaging, labeling, and preparation for shipment will follow procedures specified in the field sampling plan.

C. Tank Trailers or Above-Ground Storage Tanks

1. A sampling team of two is required. One will collect samples, the other will relay required equipment and implements.

- 2. Samples will be collected through the manhole (hatch) on top of the tanker or the fill port. Do not open valves at the bottom. Before opening the hatch, check for a pressure gauge or release valve. Open the release valve slowly to bring the tank to atmospheric pressure.
- 3. If tank pressure is too great, or venting releases large amounts of toxic gas, discontinue venting and sampling immediately. Measure vented gas with organic vapor analyzer and explosimeter.
- 4. If no release valve exists, slowly loosen hatch cover bolts to relieve pressure in the tank. (Again, stop if pressure is too great.)
- 5. Once pressure in tank has been relieved, open the hatch and withdraw sample using one of the recommended sampling devices.
- 6. Sample each trailer compartment.
- 7. If compositing is necessary, ship samples to laboratory in separate containers for laboratory compositing.
- 8. Samples will be handled as hazardous. Samples will be placed in appropriate containers and packed with ice in a cooler. Packaging, labeling, and preparation for shipment will follow procedures specified in the field sampling plan.

D. Refer to Attachment B for procedures for sampling with appropriate devices as follows:

Drum

Glass tube – Procedure 1 COLIWASA – Procedure 2

Storage Tank and Tank Trailer

COLIWASA — Procedure 2
Bacon Bomb — Procedure 3
Gravity Corer — Procedure 4

(for bottom sludge)

VII. Contamination Control

Sampling tools, instruments, and equipment will be protected from sources of contamination prior to use and decontaminated after use as specified in SOP *Decontamination of Personnel and Equipment*. Liquids and materials from decontamination operations will be handled in accordance with the waste management plan. Sample containers will be protected from sources of contamination. Sampling personnel shall wear chemical resistant gloves when handling any samples. Gloves will be decontaminated or disposed of between samples.

VIII. Attachments

- A. Collection of Liquid-Containerized Wastes Using Glass Tubes
- B. Sampling Containerized Wastes Using the Composite Liquid Waste Sample (COLIWASA)
- C. Sampling Containerized Wastes Using the Bacon Bomb Sampler
- D. Gravity Corer for sampling Sludges in Large Containers
- E. Construction of a Typical COLIWASA
- F. Drum Opening Techniques and Equipment

IX. Field Checklist

Labels
Sampling and Analysis Plan
Health and Safety Plan
Decontamination Equipment
Lab Wipes
Lab Spatulas or Stainless Stee
Spoons
Chemical Preservatives, as required
Appropriate Containers for
Waste and Equipment
Duct Tape
Plastic Sheeting

Attachment A Collection of Liquid-Containerized Wastes Using Glass Tubes

Discussion

Liquid samples from opened containers (i.e., 55-gallon drums) are collected using lengths of glass tubing. The glass tubes are normally 122 centimeters long and 6 to 16 millimeters inside diameter. Larger diameter tubes may be used for more viscous fluids if sampling with the small diameter tube is not adequate. The tubing is broken and discarded in the container after the sample has been collected, eliminating difficult cleanup and disposal problems. This method should not be attempted with less than a two-person sampling team.

Uses

This method provides for a quick, relatively inexpensive means of collecting concentrated containerized wastes. The major disadvantage is from potential sample loss that is especially prevalent when sampling low-viscosity fluids. Splashing can also be a problem and proper protective clothing should always be worn.

Note: A flexible tube with an aspirator attached is an alternative method to the glass tube, and allows various levels to be sampled discretely.

- 1. Remove cover from sample container.
- 2. Insert glass tubing almost to the bottom of the container. Tubing should be of sufficient length so that at least 30 centimeters extend above the top of the container.
- 3. Allow the waste in the drum to reach its natural level in the tube.
- 4. Cap the top of the tube with a safety-gloved thumb or a stopper.
- 5. Carefully remove the capped tube from the drum. If the tube has passed through more than one layer, the boundary should be apparent in the glass tube.
- 6. Insert the bottom, uncapped end into the sample container.
- 7. Partially release the thumb or stopper on the top of the tube and allow the sample to slowly flow into the sample container. If separation of phases is desired, cap off tube before the bottom phase has completely emptied. It may be advisable to have an extra container for "waste," so that the fluid on either side of the phase boundary can be directed into a separate container, allowing collection of pure phase liquids in the sample containers. The liquid remaining after the boundary fluid is removed is collected in yet a third container. NOTE: It is not necessary to put phases in separate containers if analysis of separate phases is not desired.
- 8. Repeat steps 2 through 6 if more volume is needed to fill the sample container.

9. Remove the tube from the sample container and replace the tube in the drum, breaking it, if necessary, in order to dispose of it in the drum.

Optional Method (if sample of bottom sludge is desired)

- 1. Remove the cover from the container opening.
- 2. Insert glass tubing slowly almost to the bottom of the container. Tubing should be of sufficient length so that at least 30 cm extends above the top of the container.
- 3. Allow the waste in the drum to reach its natural level in the tube.
- 4. Gently push the tube towards the bottom of the drum into the sludge layer. Do not force it.
- 5. Cap the top of the tube with a safety-gloved thumb or stopper.
- 6. Carefully remove the capped tube from the drum and insert the uncapped end into the sample container.
- 7. Release the thumb or stopper on the top of the tube and allow the sample container to fill to approximately 90 percent of its capacity. If necessary, the sludge plug in the bottom of the tube can be dislodged with the aid of the stainless steel laboratory spatula.
- 8. Repeat if more volume is needed to fill sample container and recap the tube.

Note:

- 1. If a reaction is observed when the glass tube is inserted (violent agitation, smoke, light, etc.), the investigators should leave the area immediately.
- 2. If the glass tube becomes cloudy or smoky after insertion into the drum, the presence of hydrofluoric acid maybe indicated, and a comparable length of rigid plastic tubing should be used to collect the sample.
- 3. When a solid is encountered in a drum (either layer or bottom sludge) the optional method described above may be used to collect a core of the material, or the material may be collected with a disposable scoop attached to a length of wooden or plastic rod.

Attachment B: Sampling Containerized Wastes using the Composite Liquid Waste Sampler (COLIWASA)

Discussion

The COLIWASA is a much-cited sampler designed to permit representative sampling of multiphase wastes from drums and other containerized wastes. The sampler is commercially available or can be easily fabricated from a variety of materials, including PVC, glass, or Teflon. In its usual configuration it consists of a 152 cm by 4 cm (inside diameter) section of tubing with a neoprene stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end. Manipulation of the locking mechanism opens and closes the sampler by raising and lowering the neoprene stopper. See Attachment E: Construction of a COLIWASA.

Uses

The COLIWASA is primarily used to sample containerized liquids. The PVC COLIWASA is reported to be able to sample most containerized liquid wastes except for those containing ketones, nitrobenzene, dimethylforamide, mesityloxide, and tetrahydrofuran. A glass COLIWASA is able to handle all wastes unable to be sampled with the plastic unit except strong alkali and hydrofluoric acid solutions. Due to the unknown nature of many containerized wastes, it would therefore be advisable to eliminate the use of PVC materials and use samplers composed of glass or Teflon.

The major drawback associated with using a COLIWASA is concern for decontamination and costs. The sampler is difficult, if not impossible, to decontaminate in the field, and its high cost in relation to alternative procedures (glass tubes) makes it an impractical throwaway item. It still has applications, however, especially in instances where a true representation of a multiphase waste is absolutely necessary.

- 1. Check to make sure the sampler is functioning properly. Adjust the locking mechanism, if present, to make sure the neoprene rubber stopper provides a tight closure.
- 2. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.
- 3. Slowly lower the sampler into the liquid waste. Lower the sampler at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and will result in a non-representative sample.
- 4. When the sampler stopper hits the bottom of the waste container, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the

- closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.
- 5. Slowly withdraw the sampler from the waste container with one hand while wiping the sampler tube with a laboratory wipe with the other hand. A phase boundary, if present, can be observed through the tube.
- 6. Carefully discharge the sample into a suitable sample container by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container.
- 7. Unscrew the T-handle of the sampler and disengage the locking block.

Attachment C: Sampling Containerized Wastes using the Bacon Bomb Sampler

Discussion

The Bacon Bomb is designed for the withdrawal of samples from various levels within a storage tank. It consists of a cylindrical body with an internal tapered plunger that acts as a valve to admit the sample. A line attached to the top of the plunger is used to open and close the valve. A removable cover provides a point of attachment for the sample line and has a locking mechanism to keep the plunger closed after sampling. The Bacon Bomb is usually constructed of chrome-plated brass and bronze with a rubber O-ring acting as the plunger-sealing surface. Stainless steel versions are also available. The volumemetric capacity is 8, 16, or 32 oz (237, 473, or 946 ml).

<u>Uses</u>

The Bacon Bomb is a heavy sampler suited best for viscous materials held in large storage tanks or in lagoons. If a more non-reactive sampler is needed, the stainless steel version would be used, or any of the samplers could be coated with Teflon.

- 1. Attach the sample line and the plunger line to the sampler.
- 2. Measure and then mark the sampling line at the desired depth.
- 3. Gradually lower the sampler by the sample line until the desired level is reached.
- 4. When the desired level is reached, pull up on the plunger line and allow the sampler to fill for a sufficient length of time before releasing the plunger line to seal off the sampler.
- 5. Retrieve the sampler by the sample line, being careful not to pull up on the plunger line, thereby accidentally opening the bottom valve.
- 6. Wipe off the exterior of the sampler body.
- 7. Position the sampler over the sample container and release its contents by pulling up on the plunger line.

Attachment D: Gravity Corer for Sampling Sludges in Large Containers

Discussion

A gravity corer is a metal tube with a replaceable tapered nosepiece on the bottom and a ball or other type of check valve on the top. The check valve allows water to pass through the corer on descent but prevents a washout during recovery. The tapered nosepiece facilitates cutting and reduces core disturbance during penetration. Most corers are constructed of brass or steel and many can accept plastic liners and additional weights.

Uses

Corers are capable of collecting samples of most sludges and sediments. They collect essentially undisturbed samples that represent the strata profile that may develop in sediments and sludges during variations in the deposition process. Depending on the density of the substrate and the weight of the corer, penetration to depths of 75 cm (30 in.) can be attained. Exercise care when using gravity corers in vessels or lagoons that have liners because penetration depths could exceed those of the substrate; this could result in damage to the liner material.

- 1. Attach a precleaned corer to the required length of sample line. Solid braided 5-mm (3/16-in.) nylon line is sufficient; however, 20-mm (3/4-in.) nylon is easier to grasp during hand hoisting. An additional weight can be attached to the outside of the corer if necessary.
- 2. Secure the free end of the line to a fixed support to prevent accidental loss of the corer.
- 3. Allow corer to free fall through the liquid to the bottom.
- 4. Retrieve corer with a smooth, continuous, up-lifting motion. Do not bump corer because this may result in some sample loss.
- 5. Remove nosepiece from corer and slide sample out of corer into stainless steel or Teflon pan (preferred).
- 6. Transfer sample into appropriate sample bottle with a stainless steel lab spoon or laboratory spatula.

Attachment E: Construction of a Typical COLIWASA

The sampling tube consists of a 1.52-m (5-ft) by 4.13-cm (1-5/8 in) I.D. translucent plastic pipe, usually polyvinyl chloride (PVC) or borosilicate glass plumbing tube. The closurelocking mechanism consists of a short-length, channeled aluminum bar attached to the sampler's stopper rod by an adjustable swivel. The aluminum bar serves both as a T-handle and lock for the samplers' closure system. When the sampler is in the open position, the handle is placed in the T-position and pushed down against the locking block. This manipulation pushes out the neoprene stopper and opens at the sampling tube. In the closed position, the handle is rotated until one leg of the T is squarely perpendicular against the locking block. This tightly seats the neoprene stopper against the bottom opening of he sampling tube and positively locks the sampler in the closed position. The closure tension can be adjusted by shortening or lengthening the stopper rod by screwing it in or out of the T-handle swivel. The closure system of the sampler consists of a sharply tapered neoprene stopper attached to a 0.95-cm (3/8-in) O.D. rod, usually PVC. The upper end of the stopper rod is connected to the swivel of the aluminum T-handle. The sharply tapered neoprene stopper can be fabricated according to specifications by plastic-products manufacturers at an extremely high price, or it can be made in-house by grinding down the inexpensive stopper with a shop grinder.

COLIWASA samplers are typically made out of plastic or glass. The plastic type consists of translucent plastic (usually PVC) sampling tube. The glass COLIWASA uses borosilicate glass plumbing pipe as the sampling tube and a Teflon plastic stopper rod. For purpose of multiphase sampling, clear plastic or glass is desirable in order to observe the profile of the multiphase liquid.

The sampler is assembled as follows:

- a. Attach the swivel to the T-handle with the 3.18-cm (1-1/4 in) long bolt and secure with the 0.48-cm (3/16-in) National Coarse (NC) washer and lock nut.
- b. Attach the PFTE stopper to one end of the stopper rod and secure with the 0.95-cm (3/8-in) washer and lock nut.
- c. Install the stopper and stopper rod assembly in the sampling tube.
- d. Secure the locking block sleeve on the block with glue or screw. This block can also be fashioned by shaping a solid plastic rod on a lathe to the required dimension.
- e. Position the locking block on top of the sampling tube such that the sleeveless portion of the block fits inside the tube, the sleeve sits against the top end of the tube, and the upper end of the stopper rod slips though the center hole of the block.
- f. Attach the upper end of the stopper rod to the swivel of the T-handle.
- g. Place the sampler in the close position and adjust the tension on the stopper by screwing the T-handle in or out.

Attachment F: Drum Opening Techniques and Equipment 1

Introduction

The opening of closed drums prior to sampling entails considerable risk if not done with the proper techniques, tools, and safety equipment. The potential for vapor exposure, skin exposure due to splash or spraying, or even explosion resulting from sparks produced by friction of the tools against the drum, necessitate caution when opening any closed container. Both manual drum opening and remote drum opening will be discussed in the following paragraphs. When drums are opened manually risks are greater than when opened remotely; for this reason, the remote opening of drums is advised whenever possible.

Prior to sampling, the drums should be staged to allow easy access. Also, any standing water or other material should be removed from the container top so that the representative nature of the sample is not compromised when the container is opened. There is also the possibility of encountering a water-reactive substance.

II. Manual Drum Opening

A. Bung Wrench

A common method for opening drums manually is using a universal bung wrench. These wrenches have fittings made to remove nearly all commonly encountered bungs. They are usually constructed of cast iron, brass, or a bronze-beryllium (a non-sparking alloy formulated to reduce the likelihood of sparks). The use of bung wrenches marked "NON SPARKING" is encouraged. However, the use of a "NON SPARKING" wrench does not completely eliminate the possibility of spark being produced. Such a wrench only prevents a spark caused by wrench-to-bung friction, but it cannot prevent sparking between the threads on the drum and the bung.

A simple tool to use, the fitting on the bung wrench matching the bung to be removed is inserted into the bung and the tool is turned counterclockwise to remove the bung. Since the contents of some drums may be under pressure (especially, when the ambient temperature is high), the bung should be turned very slowly. If any hissing is heard, the person opening the drum should back off and wait for the hissing to stop. Since drums under pressure can spray out liquids when opened, the wearing of appropriate eye and skin protection in addition to respiratory protection is critical.

¹ Taken from EPA Training Course: "Sampling for Hazardous Materials," U.S. Environmental Protection Agency, Office of Emergency and Remedial Response Support Division, March 24, 1987.

B. Drum Deheader

One means by which a drum can be opened manually when a bung is not removable with a bung wrench is by using a drum deheader. This tool is constructed of forged steel with an alloy steel blade and is designed to cut the lid of a drum off or part way off by means of a scissors-like cutting action. A limitation of this device is that it can be attached only to closed head drums (i.e., DOT Specification 17E and 17F drums); drums with removable heads must be opened by other means.

Drums are opened with a drum deheader by first positioning the cutting edge just inside the top chime and then tightening the adjustment screw so that the deheader is held against the side of the drum. Moving the handle of the deheader up and down while sliding the deheader along the chime will enable the entire top to be rapidly cut off if so desired. If the top chime of a drum has been damaged or badly dented it may not be possible to cut the entire top off. Since there is always the possibility that a drum may be under pressure, the initial cut should be made very slowly to allow for the gradual release of any built-up pressure. A safer technique would be to employ a remote pressure release method prior to using the deheader.

C. Hand Pick or Spike

When a drum must be opened and neither a bung wrench nor a drum deheader is suitable, then it can be opened for sampling by using a hand pick, pickaxe, or spike. These tools are usually constructed of brass or a non-sparking alloy with a sharpened point that can penetrate the drum lid or head when the tool is swung. The hand picks or pickaxes that are most commonly used are commercially available, whereas the spikes are generally uniquely fabricated 4- foot long poles with a pointed end. Often the drum lid or head must be hit with a great deal of force in order to penetrate it. Because of this, the potential for splash or spraying is greater than with other opening methods and therefore this method of drum opening is not recommended, particularly when opening drums containing liquids. Some spikes used for drum opening have been modified by the addition of a circular splash plate near the penetrating end. This plate acts as a shield and reduces the amount of splash in the direction of the person using the spike. Even with this shield, good splash gear is essential.

Since drums, some of which may be under pressure, cannot be opened slowly with these tools, "sprayers" may result and appropriate safety measures must be taken. The pick or spike should be decontaminated after each drum is opened to avoid cross contamination and/or adverse chemical reaction from incompatible materials.

III. Remote Opening

A. Backhoe Spike

The most common means used to open drums remotely for sampling is the use of a metal spike attached or welded to a backhoe bucket. In addition to being very efficient, this method can greatly reduce the likelihood of personnel exposure.

Drums should be "staged," or placed in rows with adequate aisle space to allow ease in backhoe maneuvering. Once staged, the drums can be quickly opened by punching a hole in the drum head or lid with the spike.

The spike should be decontaminated after each drum is opened to prevent cross contamination. Even though some splash or spray may occur when this method is used, the operator of the backhoe can be protected by mounting a large shatter-resistant shield in front of the operator's cage. This, combined with the normal sampling safety gear, should be sufficient to protect the operator. Additional respiratory protection can be afforded by providing the operator with an on-board airline system. The hole in the drum can be sealed with a cork.

B. Hydraulic Devices

Recently, remotely operated hydraulic devices have been fabricated to open drums remotely. One such device is discussed here. This device uses hydraulic pressure to pierce through the wall of a drum. It consists of a manually operated pump that pressurizes oil through a length of hydraulic line. A piercing device with a metal point is attached to the end of this line and is pushed into the drum by the hydraulic pressure. The piercing device can be attached so that a hole for sampling can be made in either the side or the head/lid of the drum. Some of the metal piercers are hollow or tube-like so that they can be left in place, if desired, and serve as a permanent tap or sampling port. The piercer is designed to establish a tight seal after penetrating the container.

C. Pneumatic Devices

Pneumatically-operated devices utilizing compressed air have been designed to remove drum bungs remotely. A pneumatic bung remover consists of a compressed air supply (usually SCBA cylinders) that is controlled by a heavy-duty, 2-stage regulator. A high pressure air line of desired length delivers compressed air to a pneumatic drill that is adapted to turn a bung fitting (preferably, a bronze-beryllium alloy) selected to fit the bung to be removed. An adjustable bracketing system has been designed to position and align the pneumatic drill over the bung. This bracketing system must be attached to the drum before the drill can be operated. Once the bung has been loosened, the bracketing system must be removed before the drum can be sampled. This attachment and removal procedure is time- consuming and is the major drawback of this device. This remote bung opener does not permit the slow venting of the container, and therefore appropriate precautions must be taken. It also requires the container to be upright and relatively level. Bungs that are rusted shut cannot be removed with this device.

IV. Summary

The opening of closed containers is one of the most hazardous site activities. Maximum efforts would be made to ensure the safety of the sampling team. Proper protective equipment and a general wariness of the possible dangers will minimize the risk inherent to sampling operations. Employing proper drum opening

techniques and equipment will also safeguard personnel. The use of remote sampling equipment whenever feasible is highly recommended.

Chain-of-Custody

I Purpose

The purpose of this SOP is to provide information on chain-of-custody procedures.

II Scope

This procedure describes the steps necessary for transferring samples through the use of Chain-of-Custody Records. A Chain-of-Custody Record is required, without exception, for the tracking and recording of samples collected for on-site or off-site analysis (chemical or geotechnical) during program activities (except wellhead samples taken for measurement of field parameters). Use of the Chain-of-Custody Record Form creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. This procedure identifies the necessary custody records and describes their completion. This procedure does not take precedence over region specific or site-specific requirements for chain-of-custody.

III Definitions

Chain-of-Custody Record Form - A Chain-of-Custody Record Form is a printed two-part form that accompanies a sample or group of samples as custody of the sample(s) is transferred from one custodian to another custodian. One copy of the form must be retained in the project file.

Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is under one's custody if:

- It is in one's actual possession.
- It is in one's view, after being in one's physical possession.
- It was in one's physical possession and then he/she locked it up to prevent tampering.
- It is in a designated and identified secure area.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the point and time that it was collected.

IV Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other, approved procedures are developed. The Project Manager is responsible for development of documentation of procedures which deviate from those presented herein. The Project Manager is responsible for ensuring that chain-of-custody procedures are implemented. The Project Manager also is responsible for determining that custody procedures have been met by the analytical laboratory.

Field Team Leader - The Field Team Leader is responsible for determining that chain-of-custody procedures are implemented up to and including release to the shipper or laboratory. It is the responsibility of the Field Team Leader to ensure that these procedures are implemented in the field and to ensure that personnel performing sampling activities have been briefed and trained to execute these procedures.

Sample Personnel - It is the responsibility of the field sampling personnel to initiate chain-of-custody procedures, and maintain custody of samples until they are relinquished to another custodian, the sample shipper, or to a common carrier.

V Procedures

The term "chain-of-custody" refers to procedures which ensure that evidence presented in a court of law is valid. The chain-of-custody procedures track the evidence from the time and place it is first obtained to the courtroom, as well as providing security for the evidence as it is moved and/or passed from the custody of one individual to another.

Chain-of-custody procedures, recordkeeping, and documentation are an important part of the management control of samples. Regulatory agencies must be able to provide the chain-of-possession and custody of any samples that are offered for evidence, or that form the basis of analytical test results introduced as evidence. Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed.

V.1 Sample Identification

The method of identification of a sample depends on the type of measurement or analysis performed. When *in situ* measurements are made, the data are recorded directly in bound logbooks or other field data records with identifying information.

Information which shall be recorded in the field logbook, when in-situ measurements or samples for laboratory analysis are collected, includes:

- Field Sampler(s),
- Task Order (TO) Number,
- Project Sample Number,
- Sample location or sampling station number,

- Date and time of sample collection and/or measurement,
- Field observations,
- Equipment used to collect samples and measurements, and
- Calibration data for equipment used

Measurements and observations shall be recorded using waterproof ink.

V.1.1 Sample Label

Samples, other than for *in situ* measurements, are removed and transported from the sample location to a laboratory or other location for analysis. Before removal, however, a sample is often divided into portions, depending upon the analyses to be performed. Each portion is preserved in accordance with the Sampling and Analysis Plan. Each sample container is identified by a sample label (see Attachment A). Sample labels are provided, along with sample containers, by the analytical laboratory. The information recorded on the sample label includes:

- Project TO Number.
- Station Location The unique sample number identifying this sample.
- Date A six-digit number indicating the day, month, and year of sample collection (e.g., 01/21/08).
- Time A four-digit number indicating the 24-hour time of collection (for example: 0954 is 9:54 a.m., and 1629 is 4:29 p.m.).
- Medium Water, soil, sediment, sludge, waste, etc.
- Sample Type Grab or composite.
- Preservation Type and quantity of preservation added.
- Analysis VOA, BNAs, PCBs, pesticides, metals, cyanide, other.
- Sampled By Printed name of the sampler.
- Remarks Any pertinent additional information.

The sample nomenclature for Naval Station Norfolk is provided in Attachment B. Using only the work assignment number of the sample label maintains the anonymity of sites. This may be necessary, even to the extent of preventing the laboratory performing the analysis from knowing the identity of the site (e.g., if the laboratory is part of an organization that has performed previous work on the site). The field team should always follow the sample ID system prepared by the project EIS and reviewed by the Project Manager.

V.2 Chain-of-Custody Procedures

After collection, separation, identification, and preservation, the sample is maintained under chain-of-custody procedures until it is in the custody of the analytical laboratory and has been stored or disposed of.

V.2.1 Field Custody Procedures

- Samples are collected as described in the site Sampling and Analysis Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the Chain-of-Custody Record exactly.
- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.
- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once downloaded to the server or developed, the electronic files or photographic prints shall be serially numbered, corresponding to the logbook descriptions; photographic prints will be stored in the project files. To identify sample locations in photographs, an easily read sign with the appropriate sample/location number should be included.
- Sample labels shall be completed for each sample, using waterproof ink unless prohibited by weather conditions (e.g., a logbook notation would explain that a pencil was used to fill out the sample label if the pen would not function in freezing weather.)

V.2.2 Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. A Chain-of-Custody Record Form example is shown in Attachment C. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory. The Chain-of-Custody Record is filled out as given below:

- Enter header information (CTO number, samplers, and project name).
- Enter sample specific information (sample number, media, sample analysis
 required and analytical method grab or composite, number and type of sample
 containers, and date/time sample was collected).
- Sign, date, and enter the time under "Relinquished by" entry.
- Have the person receiving the sample sign the "Received by" entry. If shipping samples by a common carrier, print the carrier to be used in this space (i.e., Federal Express).
- If a carrier is used, enter the airbill number under "Remarks," in the bottom right corner;

- Place the original (top, signed copy) of the Chain-of-Custody Record Form in a plastic zipper-type bag or other appropriate sample-shipping package. Retain the copy with field records.
- Sign and date the custody seal, a 1-inch by 3-inch white paper label with black lettering and an adhesive backing. Attachment D is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals shall be provided by the analytical laboratory.
- Place the seal across the shipping container opening (front and back) so that it would be broken if the container were to be opened.
- Complete other carrier-required shipping papers.

The custody record is completed using waterproof ink. Any corrections are made by drawing a line through and initialing and dating the change, then entering the correct information. Erasures are not permitted.

Common carriers will usually not accept responsibility for handling Chain-of-Custody Record Forms; this necessitates packing the record in the shipping container (enclosed with other documentation in a plastic zipper-type bag). As long as custody forms are sealed inside the shipping container and the custody seals are intact, commercial carriers are not required to sign the custody form.

The laboratory representative who accepts the incoming sample shipment signs and dates the Chain-of-Custody Record, completing the sample transfer process. It is then the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis.

VI Quality Assurance Records

Once samples have been packaged and shipped, the Chain-of-Custody copy and airbill receipt become part of the quality assurance record.

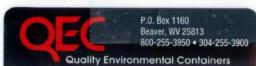
VII Attachments

- A. Sample Label
- B. Naval Station Norfolk Sample Nomenclature
- C. Chain of Custody Form
- D. Custody Seal

VIII References

USEPA. *User's Guide to the Contract Laboratory Program*. Office of Emergency and Remedial Response, Washington, D.C. (EPA/540/P-91/002), January 1991.

Attachment A: Sample Label



SAMPLE DATE

SAMPLE TIME

GRAB COMPOSITE

PROJECT NAME

SAMPLE ID

SAMPLED BY

PRESERVATIVE

ANALYSIS REQUESTED



SAMPLE DATE		
SAMPLE TIME		
GRAB		

ANALYSIS REQUESTED

P.0. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME

SAMPLE ID	SAMPLE DATE		
SAMPLED BY	SAMPLE TIME		
PRESERVATIVE	GRAB COMPOSITE		
ANALYSIS REQUESTED			

P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers
PROJECT NAME

SAMPLE ID	SAMPLE DATE		
SAMPLED BY	SAMPLE TIME		
PRESERVATIVE	GRAB		
ANALYSIS REQUESTED	COMPOSITE		

Attachment B: Naval Station Norfolk Nomenclature

First Segment		Second Segment			
Facility	Location Type	Location Number	Station Type	Station Number	Qualifier
Α	AA	NNN	AA	NNN	AAAA

raciii	ty Location Type	Location Number	Sia	tion i	ype	Station Number	Qualifier
Α	AA	NNN		AA		NNN	AAAA
Note: "N" = numeric, "A" = alphanumeric							
Facility:			Statio	n Ty	pe:		
NB =	Naval Station Norfolk		BI*	=		ample stations (i.e.,	benthic [B].
						C], fish [F], mussels	
Location T	vpe:		DR	=	Drum	- j, [. j,	[],,
S =	Installation restoration si	te	GP	=		sample groundwater	station (i.e.
W =	Solid waste managemen		О.			be and hydropunch)	
BG =	Non-site-specific backgro		IS	=	IDW so		
A =	Area of concern (AOC)	ouria ourripioo	IW	=	IDW wa	==	
REF =	Reference samples		ML	=		el sampler	
1121 -	recipios campios		MM	=		edia station (e.g: sur	face water and
Location N	lumber		101101	_	sedime		idoo wator and
	osal Area Near NM-37 (S	(WMI I 12)	MW	=		ring well	
	O Satellite Accumulation A		PW	=		supply well	
	37 Accumulation Area (S		PZ	=	Piezom		
OTO TAIVI	or recumulation rica (6	vvivio 10)	RW	=		lwater recovery well	
01 – Camr	Allen Landfill (Ste 1)		SA	=		y sewer	
	Slag Pile (Site 2)		SD	=		ent sample location	
03 – Q-Are			SEEF				
	andfill (Site 6)		SG	=	Soil gas		1
	er NM Waste Storage (Sit	·o 18)	SL	=		line (sanitary)	
	Site (Site 20)	.6 10)	SO	=		mple location	
	o Allen Salvage Yard (Site	. 22)	ST	=	Storm s	•	
	ing LP-20 Plating Shop (S		SW	=		e water sample locat	ion
25 – Dullul	ing Li -20 i lating Shop (S	116 23)	TP	=		location	1011
			TW	=		rary well	
			1 0 0	-	rempo	ialy well	
			Static	n Nii	mhor:		
					<u>mber:</u> Well Nu	mher	
			IVIOIIII	oring	vveli ivui	IIDEI	
			Quali	fier.			
				=	Shallow	Well (<15 ft)	
			ח	_		ell (15-30 ft)	

D P Y T Deep Well (15-30 ft)
duplicate sample
Yorktown Aquifer Well
Screened Across Shallow and Deep

First Segment		Sec	ond Segment	Third Segment	
Facility	Location Type	Location Number	Sample Type	Sample Qualifier Number	Additional Qualifiers (sample depth, sampling round, etc.)
Α	AA	NNN	AA	NNN or A NNNN	As applicable
		Notes: "A" = alphabetic	"N" = numeric		
Location Type: S = Installation W = Solid ware (SWMU) BG = Non-site samples A = Area Of REF = Reference Location Number 012 - Disposal Area (12) 014 - Q-50 Satellite Area (SWMU 14)	A-specific background Concern (AOC) Ce samples Near NM-37 (SWMU Accumulation Area ulation Area (SWMU 16) dfill (Ste 1) ite 2) e 6) ste Storage (Site 18) 20) vage Yard (Site 22)		SamW = Modera SB = Sudder SD = Set SB = Sudera SB = Su	oles (<i>NN</i>) (<i>NNNNNN</i>) nonth, day, and year of	Additional Qualifiers: 1. QC Samples (NN) Sequential QC sample number for that day (if needed) Example: NBS06-MW03-04C Groundwater samples collected from monitoring well 3 at Site 6 in the third quarter of 2004. A = 1st Quarter B = 2nd Quarter C = 3nd Quarter C = 3nd Quarter D = 4th Quarter NBS06-EB011304 Equipment blank collected on January 13, 2004 during sampling at Site 6.

Notes:

- Segments are separated by a dash. Qualifiers are as applicable only

COC.doc QCed 2/3/99 QCed 5/20/03 Reviewed and Updated 01/2008 **Attachment C: Chain of Custody Form**

EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD

SHIP TO: 227 French Landing Drive, Suite 550 + Nashville, TN 37228 + 615-345-1115 + (fax) 615-846-5426

Send Results to:		Send Invoice to:				Analysis Requirements:					Lab	Lab Use Only:							
Name		Name Company Address City State, Zip Phone Fax E-mail Sampler's (Signature):													VOA Headspace Field Filtered Correct Containers Discrepancies Cust. Seals Intact Containers Intact Airbill #:		Y	NA NA NA NA NA	
Lab Use Only Lab #	Date/Time Sampled		Description	Sample Matrix				l					+			Comments	No. of Bottles	Lab l	<i>Jse Only</i> ners/Pres.
					П							T	T	T					
					Ц		\perp	┸	L		Щ	Ц	4	╙					
					Ш		_	╄	┡		Щ	\perp	4	+	_				
					Н	_	\perp	+	┝		Н	\vdash	+	+	-				
					Н		+	+			Н	\vdash	+	+	-				
					Н	+	+	╁	\vdash		Н	+	+	+	┢				
					Н	+	+	╁	┢		Н	+	+	+	+				
					Н		-	╈			Н	\dashv	+	+	t				
					H		\top	1	T		Н	\top	\top	+	T				
					П		\top	1	T		П	\top	\top	†	T				
Sample Kit Prep'd by: (Sign	ature)	Date/Time	Received By: (Sig	nature)			REI	MAF	KS:									Details	:
Relinquished by: (Signature) Relinquished by: (Signature)		Date/Time Date/Time	, , ,				- -					Page of Cooler No of Date Shipped Shipped By							
Received for Laboratory by: (Signature)		Date/Time	Temperature																

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

Attachment D: Custody Seal









Packaging and Shipping Procedures for Low-Concentration Samples

Purpose and Scope

The purpose of this guideline is to describe the packaging and shipping of low-concentration samples of various media to a laboratory for analysis.

II. Scope

The guideline only discusses the packaging and shipping of samples that are anticipated to have low concentrations of chemical constituents. Whether or not samples should be classified as low-concentration or otherwise will depend upon the site history, observation of the samples in the field, odor, and photoionization-detector readings.

If the site is known to have produced high-concentration samples in the past or the sampler suspects that high concentrations of contaminants might be present in the samples, then the sampler should conservatively assume that the samples cannot be classified as low-concentration. Samples that are anticipated to have medium to high concentrations of constituents should be packaged and shipped following procedures for dangerous-goods shipping specified by the intended shipper (e.g., Federal Express).

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III. Equipment and Materials

- Coolers
- Clear tape
- "This Side Up" labels
- "Fragile" labels
- Vermiculite
- Ziplock bags or bubble wrap
- Ice
- Chain-of-Custody form (completed)
- Custody seals

ShipLowConc.doc Revised 10/31/96 Revised 5/23/03 Reviewed 01/2008

IV. Procedures and Guidelines

Low-Concentration Samples

- A. Prepare coolers for shipment:
 - Tape drains shut.
 - Affix "This Side Up" labels on all four sides and "Fragile" labels on at least two sides of each cooler.
 - Place mailing label with laboratory address on top of coolers.
 - Fill bottom of coolers with about 3 inches of vermiculite or absorbent pads.
- B. Arrange decontaminated sample containers in groups by sample number. Consolidate VOC samples into one cooler to minimize the need for trip blanks.
- C. Affix appropriate adhesive sample labels to each container. Protect with clear label protection tape.
- D. Seal each sample bottle within a separate ziplock plastic bag or bubble wrap, if available. Tape the bag around bottle. Sample label should be visible through the bag.
- E. Arrange sample bottles in coolers so that they do not touch.
- F. If ice is required to preserve the samples, cubes should be repackaged in zip-lock bags and placed on and around the containers.
- G. Fill remaining spaces with vermiculite or absorbent pads.
- H. Complete and sign chain-of-custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or the courier.
- I Close lid and latch.
- K. Carefully peel custody seals from backings and place intact over lid openings (right front and left back). Cover seals with clear protection tape.
- L. Tape cooler shut on both ends, making several complete revolutions with strapping tape. Cover custody seals with tape to avoid seals being able to be peeled from the cooler.
- M. Relinquish to Federal Express or to a courier arranged with the laboratory. Place airbill receipt inside the mailing envelope and send to the sample documentation coordinator along with the other documentation.

Medium- and High-Concentration Samples:

Medium- and high-concentration samples are packaged using the same techniques used to package low-concentration samples, with several additional restrictions. The sample handler must refer to instructions associated with the shipping of dangerous goods for the necessary procedures for shipping by Federal Express or other overnight carrier.

V. Attachments

None.

VI. Key Checks and Items

- Be sure laboratory address is correct on the mailing label
- Pack sample bottles carefully, with adequate vermiculite or other packaging and without allowing bottles to touch
- Be sure there is adequate ice
- Include chain-of-custody form
- Include custody seals

Decontamination of Personnel and Equipment

I. Purpose

To provide general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially contaminated environments.

II. Scope

This is a general description of decontamination procedures.

III. Equipment and Materials

- Demonstrated analyte-free, deionized ("DI") water (specifically, ASTM Type II water or lab-grade DI water)
- Distilled water
- Potable water; must be from a municipal water supplier, otherwise an analysis must be run for appropriate volatile and semivolatile organic compounds and inorganic chemicals (e.g., Target Compound List and Target Analyte List chemicals)
- 2.5% (W/W) Liquinox® (or Alconox®) and water solution
- Concentrated (V/V) pesticide grade methanol (DO NOT USE ACETONE)
- Large plastic pails or tubs for Liquinox[®] and water, scrub brushes, squirt bottles for Liquinox[®] solution, methanol and water, plastic bags and sheets
- DOT approved 55-gallon drum for disposal of waste
- Phthalate-free gloves such as Nitrile
- Decontamination pad and steam cleaner/high pressure cleaner for large equipment

IV. Procedures and Guidelines

A. PERSONNEL DECONTAMINATION

To be performed after completion of tasks whenever potential for contamination exists, and upon leaving the exclusion zone.

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- 1. Wash boots in Liquinox[®] solution, then rinse with water. If disposable latex booties are worn over boots in the work area, rinse with Liquinox[®] solution, remove, and discard into DOT-approved 55-gallon drum.
- 2. Wash outer gloves in Liquinox[®] solution, rinse, remove, and discard into DOT-approved 55-gallon drum.
- 3. Remove disposable coveralls ("Tyveks") and discard into DOT-approved 55-gallon drum.
- 4. Remove respirator (if worn).
- 5. Remove inner gloves and discard.
- 6. At the end of the work day, shower entire body, including hair, either at the work site or at home.
- 7. Sanitize respirator if worn.

B. SAMPLING EQUIPMENT DECONTAMINATION – GROUNDWATER SAMPLING PUMPS

Sampling pumps are decontaminated after each use as follows.

- 1. Don phthalate-free gloves.
- 2. Spread plastic on the ground to keep equipment from touching the ground
- 3. Turn off pump after sampling. Remove pump from well and remove and dispose of tubing. Place pump in decontamination tube.
- 4. Turn pump back on and pump 1 gallon of Liquinox[®] solution through the sampling pump.
- 5. Rinse with 1 gallon of 10% methanol solution pumped through the pump. (DO NOT USE ACETONE).
- 6. Rinse with 1 gallon of tap water.
- 7. Rinse with 1 gallon of deionized water.
- 8. Keep decontaminated pump in decontamination tube or remove and wrap in aluminum foil or clean plastic sheeting.
- 9. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
- 10. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums.

C. SAMPLING EQUIPMENT DECONTAMINATION – OTHER EQUIPMENT

Reusable sampling equipment is decontaminated after each use as follows.

- 1. Don phthalate-free gloves.
- 2. Before entering the potentially contaminated zone, wrap soil contact points in aluminum foil (shiny side out).
- 3. Rinse and scrub with potable water.
- 4. Wash all equipment surfaces that contacted the potentially contaminated soil/water with Liquinox® solution.
- 5. Rinse with potable water.
- 6. Rinse with distilled or potable water and methanol solution (DO NOT USE ACETONE).
- 7. Air dry.
- 8. Rinse with deionized water.
- 9. Completely air dry and wrap exposed areas with aluminum foil (shiny side out) for transport and handling if equipment will not be used immediately.
- 10. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
- 11. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums.

D. HEALTH AND SAFETY MONITORING EQUIPMENT DECONTAMINATION

- 1. Before use, wrap soil contact points in plastic to reduce need for subsequent cleaning.
- 2. Wipe all surfaces that had possible contact with contaminated materials with a paper towel wet with Liquinox® solution, then a towel wet with methanol solution, and finally three times with a towel wet with distilled water. Dispose of all used paper towels in a DOT-approved 55-gallon drum.

E. SAMPLE CONTAINER DECONTAMINATION

The outsides of sample bottles or containers filled in the field may need to be decontaminated before being packed for shipment or handled by personnel without hand protection. The procedure is:

- Wipe container with a paper towel dampened with Liquinox[®] solution or immerse in the solution AFTER THE CONTAINERS
 HAVE BEEN SEALED. Repeat the above steps using potable water.
- 2. Dispose of all used paper towels in a DOT-approved 55-gallon drum.

F. HEAVY EQUIPMENT AND TOOLS

Heavy equipment such as drilling rigs, drilling rods/tools, and the backhoe will be decontaminated upon arrival at the site and between locations as follows:

- 1. Set up a decontamination pad in area designated by the Facility
- 2. Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

V. Attachments

None.

VI. Key Checks and Items

- Clean with solutions of Liquinox[®], methanol, and distilled water.
- Do not use acetone for decontamination.
- Drum all contaminated rinsate and materials.
- Decontaminate filled sample bottles before relinquishing them to anyone.

Disposal of Waste Fluids and Solids

I. Purpose and Scope

This SOP describes the procedures used to dispose of hazardous fluid and solid materials generated as a result of the site operations. This SOP does not provide guidance on the details of Department of Transportation regulations pertaining to the transport of hazardous wastes; the appropriate Code of Federal Regulations (49 CFR 171 through 177) should be referenced. Also, the site investigation-derived waste management plan should be consulted for additional information and should take precedence over this SOP.

II. Equipment and Materials

A. Fluids

- DOT-approved 55-gallon steel drums or Baker® Tanks
- Tools for securing drum lids
- Funnel for transferring liquid into drum
- Labels
- Paint Pens
- Marking pen for appropriate labels
- Seals for 55-gallon steel drums

B. Solids

- DOT-approved 55-gallon steel drums or rolloffs
- Tools for securing drum lids
- Paint Pens
- Plastic sheets
- Labels
- Marking pen for appropriate labels

III. Procedures and Guidelines

A. Methodology

Clean, empty drums or rolloffs or Baker® Tanks will be brought to the site by the drilling subcontractor for soil and groundwater collection and storage. The empty drums will be located at the field staging area and moved to drilling locations as required. The drums will be filled with the drilling and well installation wastes, capped, sealed, and moved to the onsite drum storage area by the drilling

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subcontractor. The full drums will separate types of wastes by media. The drums will be labeled as they are filled in the field and labels indicating that the contents are potentially hazardous affixed.

The drum contents will be sampled to determine the disposal requirements of the drilling wastes. The drum sampling will be accomplished through the collection and submittal of composite samples, one sample per 10 drums containing the same media. Similar compositing will be performed in each rolloff to obtain a representative sample. The compositing of the sample will be accomplished by collecting a specific volume of the material in each drum into a large sample container. When samples from each of the drums being sampled in a single compositing are collected, the sample will be submitted for TCLP, ignitability, corrosivity, and reactivity analysis. The analysis will be used to determine if drilling wastes are covered by land disposal restrictions.

If rolloffs are used, compositing and sampling of soil will comply with applicable state and federal regulations.

B. Labels

Drums and other containers used for storing wastes from drilling operations will be labeled when accumulation in the container begins. Labels will include the following minimum information:

- Container number
- Container contents
- Origin (source area including individuals wells, piezometers, and soil borings)
- Date that accumulation began
- Date that accumulation ended
- Generator Contact Information
- When laboratory results are received, drum labels will be completed or revised to indicate the hazardous waste constituents in compliance with Title 40 of the Code of Federal Regulations, Part 262, Subpart C.

C. Fluids

Drilling fluids generated during soil boring and groundwater discharged during development and purging of the monitoring wells will be collected in 55-gallon, closed-top drums. When a drum is filled, the bung will be secured tightly. Fluids may also be transferred to Baker® Tanks after being temporarily contained in drums to minimize the amount of drums used.

When development and purging is completed, the water will be tested for appropriate hazardous waste constituents. Compositing and sampling of fluids will comply with applicable state and federal regulations.

D. Solids

The soil cuttings from well and boring drilling will constitute a large portion of the solids to be disposed of.

The solid waste stream also will include plastic sheeting used for decontamination pads, Tyveks, disposable sampling materials, and any other disposable material used during the field operations that appears to be contaminated. These materials will be placed in designated drums.

E. Storage and Disposal

The wastes generated at the site at individual locations will be transported to the fenced drum storage area by the drilling services subcontractor. Drums should be stored on pallets on plastic sheeting to capture small spills.

Waste solid materials that contain hazardous constituents will be disposed of at an offsite location in a manner consistent with applicable solid waste, hazardous waste, and water quality regulations. Transport and disposal will be performed by a commercial firm under subcontract.

The liquid wastes meeting acceptable levels of discharge contamination may be disposed of through the sanitary sewer system at the site. Prior to disposal to the sanitary sewer system, contract arrangements will be made with the appropriate authorities. Wastes exceeding acceptable levels for disposal through the sanitary sewer system will be disposed of through contract with a commercial transport and disposal firm.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

- Check that representative samples of the containerized materials are obtained.
- Be sure that all state and federal regulations are considered when classifying waste for disposal.

CHEMets® Self Filling Ampoules

Purpose

The purpose of this SOP is to provide the manufacture instructions for the CHEMets® Self Filling Ampoules for visual colorimetric analysis of dissolved oxygen concentrations in the field.



CHEMets[®] **ampoules are designed for maximum simplicity and accuracy.** Use them for low- to medium-range colorimetric analysis. Each ampoule is 7 mm in diameter with a tapered, prescored tip. Reagents are vacuum sealed inside.

The CHEMets® Method: The analyst immerses the CHEMet ampoule in the sample and snaps the tip. The correct volume of sample is drawn in by vacuum, and a small inert gas bubble remains. Sample and reagent are mixed by tilting the ampoule so the bubble travels from end to end. In 2 minutes or less, the resulting color is compared to the appropriate color standards to quantify the result.

Low Concentrations (Less than 1 ppm.) In most cases the cylindrical comparator is used to quantify low concentrations. The filled test ampoule is placed in the center and compared with the eight color standards surrounding it.

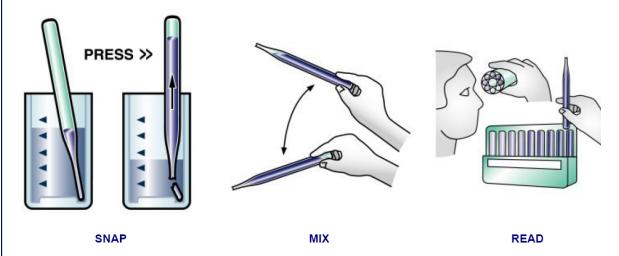
Medium Concentrations (Above 1 ppm.) The flat comparator is usually used for concentrations higher than 1 ppm. The analyst places the filled ampoule next to individual standards until a color match is found.

Use CHEMets® for fast, simple, low-to-medium range analysis.

CHEMetrics also offers

<u>Vacuettes</u>®, self-filling, auto-dillution ampoules for measuring higher concentrations, and <u>Titrets</u>®, disposable ampoules for simplified titration tests.

HOW TO USE CHEMets®



Step 1. SNAP. Fill the snap cup with your water sample, then snap the tip of a CHEMet ampoule as shown in the diagram above. Vacuum inside the tube will cause it to fill instantly with sample fluid and mix with the pre-measured reagent inside.

Step 2. MIX. Mix the contents of the filled ampoule by tilting it up and down several times, each time allowing the small bubble inside to travel from end to end.

Step 3. READ. Use one of the convenient comparators to quantify your test result. For low range testing, view the ampoule lengthwise; use the flat comparator for medium range samples.

(See also Self-filling ampoules, for auto-dilution, titration, and photometric test systems.)

Home Visual Products Products List 1-800-356-3072

http://www.chemetrics.com/chemets.html (2 of 2) [7/30/2007 7:49:22 AM]

HACH Ferrous Iron Test Kits

Purpose

The purpose of this SOP is to provide the manufacture instructions for the HACH ferrous iron test kits for visual colorimetric analysis of ferrous iron concentrations in the field.

Iron, Ferrous, Test Kit

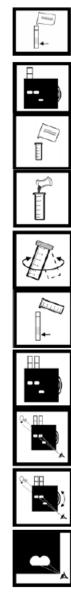
1,10 Phenanthroline Iron Reagent Method Introduction

The 1,10 phenanthroline indicator in the Ferrous Iron Reagent reacts with ferrous iron in the sample to form an orange color in proportion to the ferrous iron concentration. Ferric iron does not react. The ferric iron (Fe3+) concentration can be determined by subtracting the ferrous iron concentration from the results of a total iron test.

Prepare a ferrous iron stock solution (100 mg/L Fe) by dissolving 0.702 grams of ferrous ammonium sulfate, hexahydrate, in one liter deionized water. Dilute 5.00 mL of this solution to 100 mL with deionized water to make a 5.0 mg/L standard solution. Prepare this immediately before use. Follow the ferrous iron test instructions using this solution instead of a water sample.

Procedure

- 1. Fill a viewing tube to the first (5-mL) line with sample water
- 2. Place this tube in the top left opening of the color comparator.
- Fill the measuring vial to the 25-mL mark with sample water.
- **4.** Add the contents of one Ferrous Iron Reagent Powder Pillow to the measuring vial.
- 5. Swirl to mix. An orange color will develop if ferrous iron is present. Allow three minutes for full color development.
- **6.** Fill another viewing tube to the first (5-mL) mark with the prepared sample.
- 7. Place the second tube in the top right opening of the color comparator.
- Hold comparator up to a light source such as the sky, a window or a lamp. Look through the openings in front.
- **9.** Rotate the color disc until the color matches in the two openings.
- Read the mg/L ferrous iron in the scale window.





Laboratory SOPs are proprietary and confidential. They are held by CH2M HILL and the Navy and are available upon request



DRAFT

DATA MANAGEMENT PROCESS OVERVIEW FOR THE NAVY CLEAN AND JOINT VENTURE PROGRAMS

Prepared 7 April 2008

Prepared by



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1.0 Introduction

This Data Management Plan (DMP) was developed to provide operating guidelines to satisfy the data management requirements for large quantities of data in support of the Navy CLEAN and Joint Venture (JV) Programs. The DMP is broadly applicable to the management and dissemination of data generated during environmental investigations. It is intended to be a living document and will be amended or revised to accommodate changes in the scope of environmental investigation or data management requirements.

During field investigations, CH2M HILL will collect a variety of environmental information that will support data analysis, reporting, and presentation. To ensure quality assurance/quality control (QA/QC) and meet current regulatory requirements, a complete audit trail of the information flow must be established. Each step in the data management process (data collection, storage, and analysis) must be adequately planned, executed, and documented. The DMP provides the processes and guidelines for sample tracking, storage, access, delivery, and reporting of new chemical analytical, geologic, biologic and spatial data generated by investigation operations. Additionally, this plan addresses the management of historical data. Key data management objectives are identified and listed below.

- Provide data users with tools that allow simple and rapid access to stored data of various types
- Provide methods of data entry and data loading with known accuracy and efficiency
- Apply well-documented data validation modifications to the electronic database
- Manage sample data using a unique sample identification number
- Establish a sample inventory of new data collected, and provide methods of sample inventory reconciliation
- Store and provide sample-specific attributes, including location identifier, sample type, sample media, depth, date, and target study area
- Provide reporting and delivery formats from a single database source to support data analysis, site characterization, risk assessment, modeling, and spatial analysis
- Provide the ability to electronically compare results to project-specific reference or screening criteria
- Identify needs for incorporating historical data and establish a database of this information when possible; otherwise, establish a data inventory plan that identifies and catalogues historical data not suited for database entry

To facilitate information utilization and decision-making, a set of guidelines and specifications is presented for personnel qualifications, elements of the data management system (DMS), and activities related to data management. The following specifications are provided to ensure compatibility with the Navy CLEAN and JV Programs' goals and requirements. These specifications include the routines, processes, and guidelines for sample tracking, storage,

access, delivery, and reporting of chemical analytical, geologic, biologic and spatial data generated during site characterization, remedial investigation, and remedial action activities at the sites.

2.0 Data Management Activities

This section describes data management activities for new data and historical data. It also discusses the responsibilities of the data team members, coordination and administration of the database, integration with the geographic information system (GIS), and reporting of data from the database.

2.1 New Data Management

For new data being generated as part of field and laboratory operations, the DMP revolves around nine overlapping phases of activity.

- 1. **Project Planning and Setup:** A Kick-off Meeting is held to review project instructions, assign sample nomenclature, and detail the EIS level of effort and budget required for the project. Initial communication with the laboratory, data validator, and field crew is established to ensure that all project materials, deliverables, and specifications will be met.
- 2. Sample Collection and Tracking: Field efforts are carried out according to information detailed in the Project Instructions and Sampling and Analysis Plan (SAP). Sample information and field measurements are collected and catalogued for loading into the project database. Lab login reports are received from labs, entered into the Sample Tracking Sheet (STS) and compared to information from the Project Instructions in order to track the completeness and timeliness of sample handling and processing.
- 3. Lab Analysis and Reporting: Analyses are performed in accordance with the Laboratory Scope of Work (SOW) and the Uniform Federal Policy Sampling and Analysis Plan (UFP SAP). Hard copy and electronic data deliverables (EDDs) are delivered to the data management team in the agreed-upon format. Lab electronic data are checked for completeness and consistency with hard copy data reports.
- **4. Data Validation and Reporting**: Validation or review is performed in accordance with the Data Validation SOW and the Uniform Federal Policy Sampling and Analysis Plan (UFP SAP). Hard copy and electronic data deliverables (EDDs) are delivered to the data management team in the agreed-upon format. Validated electronic data are checked for completeness and consistency with hard copy data reports.
- **5. Project Data Loading and Storage:** Data from all phases of the data collection and analysis process are stored in a relational project repository database. Post Load reports are reviewed to verify that data was loaded correctly. Following data loading, reports are generated and reviewed to verify that data was loaded correctly. Updates and/or

corrections are made to the data as necessary. All hard copy and electronic data are catalogued and sent for archiving as appropriate. Hardcopy and electronic data are sent for archiving. All documentation generated during the projects is filed into the appropriate project notebooks.

6. Reporting and Delivery of Results: Data are exported to one or more exterior applications for generating geographic data maps, summary statistics, data tables, and other reports.

2.2 Historical Data Management

There have been a substantial number of previous studies and investigations conducted at Naval Bases. Managing historical data from these studies is complicated by the fact that the agencies and contractors performing these studies have used various data sampling, analysis, and management procedures. The variety of historical data sources and formats—including ecological reports, field data, and analytical data—must be addressed.

To manage historical data in a manner that addresses the variety of sources and formats, along with concerns regarding data validation, the following procedures will be implemented:

- All source data received will be logged and saved to CH2M HILL servers. Electronic data
 received to support data from approved documents on original data collection forms, logs,
 or laboratory reporting sheets will undergo a limited check against accompanying written
 reports to ensure their accuracy.
- 2. If only hard copy files exist for desired results, these files will be used to perform manual entry of all data into electronic database files, following a "double blind" protocol for data entry. Any discrepancies found between the two versions of each entered record will be reviewed and corrected by the data manager (DM).
- 3. When electronic data gaps occur, the DM will make the data set as complete as possible by consulting the appropriate approved documents or completed laboratory reporting sheets, through direct communication with the appropriate environmental contractor or laboratory staff, or communication with the Program Chemist. To the greatest possible extent, data will not be entered without a reliable source.
- 4. After data clean up by the DMC has been completed, the data will be reviewed by a Project Chemist (PC) using all available information. If this process finds no errors, the data will be loaded into the data repository. Any assumptions or corrections made during the cleanup and review process will be noted and tracked in an Error Resolution file

2.3 Data Management Team Members

The CH2M HILL data management team will work together to properly execute the data management process. The team model presented here is based on a Project Manager supported directly by key technology staff. The functional responsibilities of the team are described below. The responsibilities are identified by titles but not necessarily individual staff positions. The workflow among the members of the data management team is shown in Figure 1.

The Activity Manager (AM) and the Project Manager (PM) are responsible for preparing the work plan, schedule, milestones, and coordinating efforts with the client. The AM/PM may or may not have adequate skills to guide the data management driven aspects of their project. While the AM/PM must be willing to accept guidance from the technology leaders, they do not need to possess the technology skills as a background. The PM is also responsible for ensuring data quality and is brought into the team to perform data QA/QC at various times during the data management process.

The Environmental Information Specialist (EIS) assigned to the project team is responsible for the coordination of new or existing data generated by field activities or provided by laboratory analyses. The EIS oversees contracted analytical and data validation services, ensures that analytical data are complete and consistent, enters field data results into the Field Data Entry Tool(FDETool), and assists the Database Specialist in resolving any data ambiguities. The EIS will conduct verification activities following receipt of electronic data and participate in QA/QC activities to resolve inconsistencies as necessary. The EIS acts as a liaison between the Database Specialist, the PM, and the PC.

The Database Specialist has overall responsibility for the design, operation, and maintenance of the Environmental Database. The DBC is responsible for the implementation, and evaluation of standard operating procedures to ensure integrity of the enterprise-wide database system. The Database Specialist coordinates the different activity data and enhances the database tools, and structure as required to increase performance and efficiency for the entire program. Additional duties include loading data into the Environmental database. This includes analytical results from laboratory electronic data deliverables and field data results that have been entered by the EIS into the **FDETool**. The Database Specialists work with the EIS and Program Data Management Coordinator to ensure that the data are loaded successfully and following established program standards and procedures.

The Field Team Leaders (FTLs) help prepare the work plan and implement the plan in the field. FTLs assign staff members to sampling teams; assign responsibilities to team members; prepare for and coordinate sampling activities; oversee the collection, recording, and documentation of the field data; and ensure that the chain-of-custody form is completed correctly.

The Project Chemist (PC) prepares the laboratory and data validation subcontracts, ensures that the electronic data deliverable was provided in accordance with the contract, assists the EIS in communicating with laboratories and data validators as needed, assists the EIS in interpreting analytical results, assists in designating CAS Numbers to new analytes, and maintains the regulatory criteria in the database.

The Program Data Management Coordinator (DMC) is responsible for the CH2M HILL data management process at all Navy bases. The DMC manages and tracks data management personnel schedules and deliverables for the Navy program; interacts with the EIS on all aspects of data management activities; provides guidance and coordination to the EIS during resolution of data inconsistencies; coordinates completion of data queries for reports; coordinates database modification efforts with the DBC; is responsible for designing, developing, and implementing standard data entry and data retrieval tools; and leads the data management continuous process improvement investigation.

The IS Operations Lead monitors workload across all IS activities (GIS, Web, and Database) for resource and schedule conflicts, and works with IS resources to make recommendations for process change and improvement.

The IS Program Lead serves as the primary point of contact for the Navy regarding IS issues, coordinates resource requirements with regional the IS Staffing Lead, and provides direction and management to the DBC, DMC, and IS Operations Lead.

2.4 Database Management and Administration

Database management and administration will be coordinated and conducted by the Database Specialist. Activities will be conducted using a suite of previously developed tools and products: Field Data Entry Tool (FDETool) for field data loading; EDD and Supplemental Naval Installation Restoration Information Solution (NIRIS) Electronic Data Deliverable (SNEDD) formats for analytical data loading; formatting macros for data table creation, Archive and Load Prep Tool (ALPTool) for electronic file QC and generation, EnDat and/or NIRIS for long-term storage; and EnStat for rendering, reporting, and presentation of results. The data management team will focus their efforts on providing rapid data loading, entry, and retrieval, while promoting data integrity through various standardized procedures. Database administration, at the minimum, will consist of:

- Allocating system storage for the database
- Adding, altering, and deleting users, roles, and privileges
- Periodically defragmenting the database for more efficient operation
- Upgrading database software as necessary
- Providing routine backup of the database
- Maintaining an approved list of valid values for data consistency
- Maintaining redundancy control to ensure that each data record is unique and consistent with conventions

In addition to electronic tools, all required paper documentation, including hard copy of laboratory results, field notebooks, and COC sheets, will be matched to EDD files, logged, and filed in project paper files.

2.5 GIS Integration

To the greatest degree possible, spatial coordinate data will be captured and associated with all field sampling events. This will be done to facilitate the creation of spatial data maps of the sampling activities and results, which will be rendered using GIS software tools. Various data management tools used in the DMS process will provide a means of storing geospatial coordinate data.

GIS integration will allow the project team to couple results information with geospatially correct images of water bodies, topography, building and transportation infrastructure, and

other types of analytical maps. More detailed information on the requirements and specifications for GIS can be found in the project documentation for that activity.

2.6 Reporting and Submittals

The project repository database will be the analytical data source for all reports presented to the Navy CLEAN and JV Programs by CH2M HILL. Data for the reports will be extracted and aggregated using standard software tools.

As mentioned above, the EnStat application will be provided to project EISs. EnStat will allow users to electively query results from the project repository database. Internally developed table formatting macros will present the results in a variety of pre-formatted tabular reports.

3.0 Database Management System

The following sections identify the required project database tools and their relationships to each other. In addition, they discuss the procedures that maintain data integrity and security through standardized tasks, data verification through valid values and redundancy control, security and controlled access to the stored data, and file backup.

3.1 Project Database Requirements

The project repository database will be a relational database system that stores information in a series of data tables. Relational database systems are designed so that each piece of information is stored only once. Data tables can then be linked so that duplication of fields in multiple tables is avoided and consistent nomenclature is enforced between related sets of data. This architecture ensures relatively high data quality and information integrity, saves storage space on the data server, and speeds up data manipulation for large data files.

It is essential that the DMS provide features to enhance data management, including the following:

- Tools preloaded with drop down menus and valid values to limit data entry errors
- Built-in QA/QC routines to protect against data redundancy and errors
- Routines that electronically compare results to project-specific reference or screening criteria
- A project repository database that securely stores all historical and present project data
- Standard but flexible reporting and delivery formats from a single database source

3.2 Tools for Data Management System Requirements

This section describes the required data management tools to be utilized. The software tools described are internally developed applications that will provide a fully integrated solution for meeting the requirements listed above.

Table 3-1 DMS Tools

Tools	Description
Checklist - Data Management Process	Standardized checklist to ensure that all phases data management are completed.
Checklist - EDD Prep for Load and Archive Files	Standardized checklist to ensure that Load and Archive Files are generated correctly.
Checklist - EDD Prep for Raw and Detects Tables for Unvalidated or Validated Data	Standardized checklist to ensure that reporting tables are generated and formatted appropriately.
Checklist - EIS QC Checklist for Unvalidated and Validated EDDs and Hard Copy Data	Standardized checklist detailing QC checks to be performed on data
Form - Data Request/Needs	Form detailing data loading into the database repository
Form - EIS DM Budget Tracking	Form to track EIS budget allotted on project
Form - EIS Questions to Ask at Start of Project	Standardized list of questions that EISs should posed at project startup to ensure appropriate data management related project planning and implementation
Macro - EcoRisk Tables from EnStat Output	Macro to format EcoRisk data tables
Macro - HHRA Tables from EnStat Output	Macro to format HHRA data tables
Macro - Raw & Detects Tables from Unvalidated or Validated EDD	Macro to generate and format Unvalidated or Validated data tables
Macro - Raw, Detects, & Exceedance Tables from EnStat Output	Macro to format final Raw, Detects, and Exceedances data tables pulled from EnStat
Template - Corrections to File Letter	General template for the generation of Corrections to File Letters
Template - Data Archiving (List of Contents) Form	Template to generate Data Archiving forms to affix to laboratory and data validation reports
Template - EnDat Post Load Reports	Used to assess and QC data loaded into EnDat to ensure data load accuracy and completeness
Template - IS Costing LOE	Template to generate the level of effort and overall data management budget for projects
Template - QC Association Table	General template for the generation of QC Association tables used in data validation

Tools	Description
Template - Sample Tracking Sheet	General template for the set up of project Sample Tracking Sheets
Template - Station and Sample Nomenclature	Program template outlining the Station and Sample Nomenclature rules to be used on environmental projects
Tool - ALPTool	Internally developed tool for performing an Analyte ID QC on SNEDD files, and generating EnDat Archive, EnDat Load, and NIRIS Analytical NEDD files.
Tool - EnDat	Internally developed relational database repository
Tool - EnStat	Internally developed tool for querying and reporting data from EnDat
Tool - FDETool	Internally developed tool for the input and loading of sample and field data.
Tool - NIRIS	Navy developed relational database repository
Tool - Projects Currently in DM Tracking Table	Internal tool for tracking the status of all current data management projects
Tool - EDD	Standardized internal CH2M HILL electronic deliverable format for loading data into only EnDat
Tool - SNEDD	Standardized internal CH2M HILL electronic deliverable format for loading data into EnDat and NIRIS
Tool - Valid Value Reference Tables	Reference tables detailing all valid values utilized in the DMS

3.3 Data Integrity

3.3.1 Valid Values and Referential Integrity

Applications and tools throughout the DMS will use the same reference tables when applying reference attributes to project data. Such reference data include the names of site objects and sampling locations, sampling matrix and method categories, detection limits, analyte names, etc. The use of these reference tables is critical for maintaining the completeness and accuracy of data sets and how they are grouped and categorized.

All data must be loaded and stored in such a manner that relationships between categories of data are enforced. For instance, all sampling records must be associated with a valid site object such as a planned sediment sampling location. The project repository database and all collection, analysis, and reporting tools used in the DMS are designed to enforce, for any project

data record entered, entries in fields that refer to other types of data as required by the overall data model.

Note that the DMS has numerous features that reduce or eliminate manual data entry and manipulation. Automation generally promotes the integrity of data by eliminating the need for manual keystrokes and, hence, key stroke errors. These features include look-up lists on data entry forms to ensure the values of key reference information, and standardized QA/QC routines on lab and validated data.

3.3.2 Electronic Data Deliverable Requirements

Tables 3-2 and 3-3 provide the format standards for laboratory electronic data. The SNEDD format depicted in Table 3-2 is intended for use by all laboratories supplying electronic data deliverables for newly acquired Contract Task Orders (CTOs). The format depicted in Table 3-3 is an auxiliary file intended for use on previous CTOs that were established before the SNEDD process was implemented.

Laboratories and Data Validators will be provided with comprehensive Reference and Lookup tables detailing the most current valid values to be entered into all EDDs submitted to CH2M HILL . Laboratories and Validators may submit requests for the addition of new valid values if values had not been previously established.

3.4 Security and Access

3.4.1 User Accounts

The project repository database implements controlled access to data through password-protected user accounts. These accounts, with Read, Write, and Modify access, are maintained by the Database Specialist. EISs can access the project repository database, with Read Only access, using established querying tools.

3.4.2 Virus Checking

All files received from subcontractors will be scanned for common viruses using standard and current virus protection programs.

3.5 File Backup

All internal CH2M HILL electronic files (including data management project files) that reside on servers are automatically backed up nightly.

Table 3-2 SNEDD Format

CH2M HILL SNEDD Format				
Field Name	Field Format	REQ	Field Description	
			Contract ID assigned by Division Contracting Office: format is UIC (6 char.) + FY (2	
Contract_ID	A13	R	char.) + FAR code (1 char.) + Number (4 char.). (e.g. D459559365800)	
DO_CTO_Number	A4	R	CTO or TO # assigned by Navy. (e.g. CTO-12 = 0012)	
Phase	A8	RA	Task Phase, SubTask Number or Annual Quarter. (e.g. QTR1)	
Installation_ID	A20**	R	Unique identifier for installation. (e.g. WHIDBEY)	
Sample_Name	A50	R	CH2M HILL Sample ID (from Chain Of Custody).	
CH2M_Code	A4*	R	CH2M HILL Preparation Method Code (e.g. NONS)	
Analysis_Group	A9*	R	The CH2M HILL code for the analysis performed on the sample.	
Analytical_Method	A20**	R	Analytical Method used to analyze sample fraction. (e.g. 6010)	
PRC_Code	A15**	R	NIRIS code for the analytical method category (e.g. LEACH)	
Lab_Code	A10**	R	CH2M HILL Code assigned to the laboratory (e.g. SHEA)	
Lab_Name	A50**	R	The name of the laboratory that conducted the analysis.	
Leachate_Method	A16**	RA	Code for the leachate method used on sample. (e.g. SW1310)	
Sample_Basis	A16*	RA	Sample basis of analysis; wet weight, dry weight etc. (e.g. DRY)	
Extraction_Method	A16**	RA	Code for the extraction method used on sample. (e.g. FLTRES)	
Result_Type	A16*	RA	Type of results; dilution, reanalysis etc. (e.g. 000)	
Lab_QC_Type	A15*	RA	Code for Laboratory Sample (MS, MSD, LBLK, LCS)	
Sample_Medium	A16*	R	Sample medium reported by the laboratory. (e.g. L)	
QC_Level	A16*	R	QC Level of data package: EPA levels I to IV. (e.g. 3)	
			1 0 (0)	
DateTime_Collected	MM/DD/YYYY 00:00	R	Date and time sample was collected. Use 24 hour clock. (e.g. 02/13/07 15:34)	
Date_Received	MM/DD/YYYY	R	The date the sample was received in the lab. (e.g. 03/24/07)	
Leachate Date	YYYYMMDD	RA	Date the sample was leached. (e.g. March 12, 2007 = 20070312)	
Leachate_Time	HH:MM:SS	RA	Time the sample was leached. Use 24 hour clock. (e.g. 14:30:05)	
Extraction Date	YYYYMMDD	RA	Date that the lab extracted the sample.	
Extraction Time	HH:MM:SS	RA	Time of day that the lab extracted the sample. Use 24 hour clock.	
 Analysis_Date	YYYYMMDD	R	Date that the lab performed the analysis.	
Analysis_Time	HH:MM:SS	R	Time of day that the lab extracted the sample. Use 24 hour clock.	
Lab_Sample_ID	A20	R	Unique ID assigned to the sample by the laboratory.	
Dilution	N10,2	R	Dilution factor used. (e.g. 10)	
			Number distinguishing multiple or repeat analyses by the same method, on the same	
Run_Number	N4	RA	day. Must be equal to or greater than 1.	
Percent_Moisture	N6,3	RA	Percent moisture of the sample. (e.g. 20)	
Percent_Lipid	N6,3	RA	Percent lipid of the sample.	
Chem_Name	A45*	R	The compound being analyzed.	
 Analyte_ID	A20*	R	Analyte ID (CAS Number) assigned to the analyte. (e.g. 7440-47-3)	
Analyte_Value	N18,7	R	Leave Blank for Validator to enter the final analyte concentration.	
Original_Analyte_Value	N18,7	R	Analyte concentration value originally generated by the Laboratory.	
Result_Units	A16*	R	Unit of measure for the analyte value. (e.g. UG_L)	
Lab Qualifier	A16*	RA	Lab data qualifier. Values will not be rejected if not in domain table.	
Validator Qualifier	A16*	RA	Leave blank for Validator. Values will not be rejected if not in domain table.	
GC_Column_Type	A16*	RA	Data code for the type of GC column used in an analysis.	
Analysis_Result_Type	A3*	R	Type of analysis performed (allowed: TIC or TRG).	
Result_Narrative	A120	RA	Additional information or comments associated with the result.	
QC_Control_Limit_Code	A16*	RA	Type of quality control limit. Req'd if QC criteria included. (eg. CLPA)	
			Accuracy Upper Limit. Upper QC limit of % recovery as measured for a known target	
QC_Accuracy_Upper	N6,3	RA	analyte spiked into a QC sample. (e.g. 25.45)	
,- 11	,		Accuracy Lower Limit. Lower QC limit of % recovery as measured for a known target	
QC_Accuracy_Lower	N6,3	RA	analyte spiked into a QC sample. (e.g. 10.15)	
Control_Limit_Date	YYYYMMDD	RA	Date a control limit is established.	
QC_Narrative	A120	RA	Leave blank for Validator. Enter EnDat EDD's DV_Qual_Code.	
MDL	N18,7	RA	Method Detection Limit	
Detection_Limit	N18,7	RA	Reported Detection Limit	
SDG	A50	R	Lab code for a group of samples in a data deliverable package.	
Analysis_Batch	A20	R	Laboratory code for a batch of analyses analyzed together.	
Validator_Name	A50**	R	Leave Blank. Name of Validator. (e.g. CONTRACTOR INC.)	
Val_Date	YYYYMMDD	RA	Populated by Validator/Reviewer. Validation/Review QC date.	
2 ****			, , ~	

Table 3-3 **Auxiliary EDD Format**

		CH2M F	IILL EDD Format
Field Name	Field Format	Req'd	Description
Sample_ID	A25	R	CH2M HILL sample ID (taken from the chain of custody).
Analysis_Group *	A9	R	The CH2M HILL code for the analysis performed on the sample.
DateTime_Collected	00/00/0000	R	The date the sample was collected (from the chain of custody). Use
	00:00:00		24-hour clock
Date_Received	00/00/0000	R	The date the sample was received in the lab.
Date_Extracted	00/00/0000	RA	Extraction or preparation date.
Date_Analyzed	00/00/0000	R	The date the sample was analyzed.
Lab_Sample_ID	A15	R	The laboratory sample ID.
Dilution_Factor	N5	R	The dilution factor used. Use 1 if not diluted.
SDG_Number	A15	R	Laboratory code for the group of samples in a data deliverable package.
Chem_Code	A12	R	The ERPIMS parameter code.
Chem_Name *	A45	R	The compound being analyzed.
CAS_Number *	A6-A2-A1	R	CAS Number (Note dashes).
Ana_Value	N11	R	The analytical result. It should match the number of significant digits on the hard copy. Use detection limit when not detected.
Lab_Qual *	A5	RA	The lab qualifiers, if any (e.g., U, UJ, B); there may be a qualifier not on the valid value table in special cases.
DV_Qual	A5		Left blank for data validation qualifiers.
DV_Qual_Code*	A5		Left blank for data validation qualifier codes. Use valid values.
Units *	A15	R	The unit of the result (e.g., mg/L).
Detect_Limit	N5	R	The minimum available sample-specific detection limit for the compound, the laboratory reporting limit.
MDL	N10,3	R	Method detection limit.
Preparation	A15	R	ERPIMS code used for the preparation method of the sample fraction.
Analysis_Method	A15	R	Analytical method used to analyze the sample fraction. Use ERPIMS codes.
Result_Type *	A15	RA	The laboratory QC type for single compounds (e.g., SURR, IS) All surrogates and internal standard results are to be reported in % recovery units.
Lab_QC_Type *	A15	RA	Laboratory samples (lab blanks, dups., LCS, etc.).
PCT_Moisture	N3,3	RA	Percent moisture for soil samples; not applicable for aqueous samples.
Basis	A3	RA	Concentrations are reported on a wet or dry weight basis. Use ERPIMS codes.
Batch	A12	R	Laboratory code for the batch of samples analyzed together.
Lab_Code	A10	R	The ERPIMS code for the name of the laboratory.
ReRun*	A9	RA	To report dilutions, re-extractions, and/or re-analyses.
QC_Limits	AAA-AAA	RA	Laboratory QC limits in percent recovery for surrogates, internal standards, laboratory control spikes, calibration checks, interference
			check standards, serial dilutions, and MS/MSDs.
	+	RA	

Notes:

* - See valid value list

TICs are not reported on the EDD
R - Required field
NR - Not Required
RA - Required as Appropriate
EDD to be submitted in Excel

4.0 Phases of Data Management

As outlined in Section 2.1, the movement of data from the planning stage to the repository database follows six phases, as detailed in Figure 4-1. The following sections describe for each phase how data are managed and the responsibilities of team members.

4.1 Project Planning and Setup

An initial Kick-off meeting will be held to review project instructions, subcontractor information, sample logistics, nomenclature, and project level of effort and budgets. Activities will be supported by EIS Questions to Ask at Start of Project Form, Projects Currently in DM Tracking Table, IS Costing LOE Template, STS and the Station and Sample Nomenclature Template.

The EIS will be responsible for coordinating with the laboratory to discuss the sampling schedule, required turn around times, bottle orders, sample labels, etc. If requested, order bottle ware and create sample labels. If requested, once the bottles have arrived, the order will be reviewed to ensure the proper amount and type of equipment has arrived.

4.2 Sample Collection and Tracking

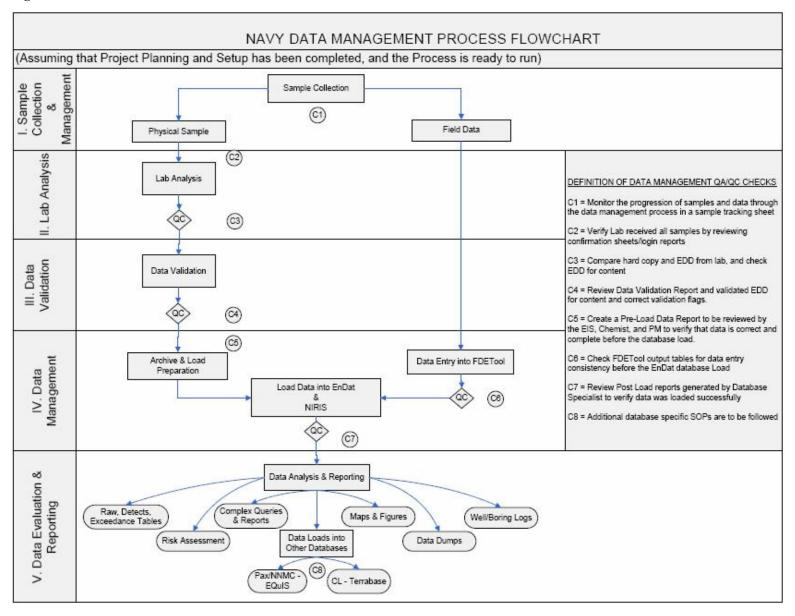
Sample control during the sampling phase is required to ensure the integrity of the associated analyte. Sample control must be maintained and documented from the point of collection through the point of disposal. Sample control will be managed both in the field and in the laboratory, and will be documented through the use of field log books and a Chain of Custody (COC). When custody of a sample is transferred from one party to another, the recipient of the sample assumes responsibility for maintaining control of the sample and documenting that control on the COC.

4.2.1 Sample Collection

A photocopy of each field logbook page completed during sampling, and of each COC, will be made by the FTL and forwarded to the DM at predefined intervals during sampling events. This information will serve as notification to the EIS of samples being shipped to an offsite lab and of the field crew's sampling progress.

Communication with field and laboratory staff will occur daily during the field event. The EIS will resolve issues that arise in the field (bottle ware shortage, equipment failure, etc). The lab will be informed of the shipment dates and the number of coolers or samples being sent. Laboratory login reports will be reviewed to ensure samples were received in good condition (no breakage, within holding time, within designated temperature). The field crew and PM will be notified if there were problems with shipment.

Figure 4-1



4.2.2 Field Data Collection

The FDETool can be completed at any time during the sampling event timeline, and will be turned in with the data load. After the lab has received the samples and submitted login reports, data will be entered into the FDETool using the STS, field log books and COCs. Once all field data has been entered, FDETool output reports will be generated and QC'd

In projects utilizing the SNEDD format deliverable, the NIRIS field-related NEDDs should be generated by the FDETool. These files will be reserved for use after the data has been loaded into EnDat and is ready for archiving.

4.2.3 Sample and Document Tracking

A STS will be generated and updated as samples are collected using Project Instruction Tables, Chains of Custody (COC), and Lab Login Reports. The Sample Tracking Sheet should be updated and kept current throughout the data management process. A 100% QC will be performed on COCs received from the field crew. The field crew and/or lab will be notified if corrections need to be made the COCs or lab login reports. Any corrections or modifications made will be noted in a Corrections-To-File Letter. All samples collected will be tracked throughout the data management process

All documentation acquired during the data management process, including Statements of Work (SOWs), Bids, COCs, Field Notes, Sample Tracking Sheets, Login Reports, Corrections-to-File Letters, FDETool QC tables, Post Load Reports, Invoices, and Communication Logs shall be compiled throughout the process to be stored in the appropriate Activity's Project Notebook.

4.3 Laboratory Analysis and Reporting

4.3.1 Sample Analysis

Upon receipt of samples from the field, the laboratory will check that the COC forms correctly cover all samples submitted. Each COC form must be signed with the date and time of receipt by the laboratory. Samples will be logged into the Laboratory Information Management System (LIMS) using information from the COC forms and the project instructions. Samples will be analyzed as specified on the accompanying COC forms and in the Laboratory SOW. Generally, questions or noted inconsistencies identified by the laboratory should be addressed directly to the PC or EIS.

4.3.2 Laboratory Reporting

The laboratory will attach the signed COCs to their hard copy data deliverables to officially relinquish control of the data back to the Environmental Contractor within the specified turn around time.

4.3.3 Laboratory Data QC

Hard copy data and EDDs will be reviewed to ensure that they are complete and acceptable as outlined in the EIS QC Checklist for Unvalidated and Validated EDDs and Hard Copy Data Form. A 10% QC check will be performed on the analysis results to ensure that the hard copy data matches the EDD. All detected errors should be resolved with the laboratory.

Preliminary raw and detects will be generated by running the EDD through the Raw & Detects Tables from Unvalidated or Validated EDD Macro to assist the PM with a preliminary data analysis. A separate table must be created for each matrix.

Data archiving forms will be generated and affixed to each laboratory report received, for cataloguing, tracking, and archiving purposes.

4.4 Data Validation and Reporting

The data validator will be notified in advance of when to expect data, and of any samples or analyses that should not be validated. (i.e. grain size should not be validated). The hard copy data, **EDDs**, and a **QC Association Table** will be mailed or emailed to the data validator. The EIS will coordinate the return of the data package to CH2M HILL for archiving with the data validator.

4.4.1 Data Validation

Upon receipt of data from CH2M HILL, data validation will be performed in accordance with the Data Validation SOW, UFP SAP, and any other documents required. Generally, questions or noted inconsistencies identified by the validator should be addressed directly to laboratory, with the EIS notified of issues and resolutions identified.

4.4.2 Validated Data Reporting

The Data Validator will provide a hardcopy and electronic version of the Data Validation Report, as well as a validated version of the EDD to the data management team in the agreed-upon format within the required turn around time.

4.4.3 Validated Data QC

The validated data will be reviewed to ensure that they are complete and acceptable as outlined in the EIS QC Checklist for Unvalidated and Validated EDDs and Hard Copy Data Form. A 100% QC check will be performed on the validated results to ensure that the hard copy data matches the EDD. All detected errors should be resolved with the data validator.

Validated raw and detects tables will be generated by running the EDD through the Raw & Detects Tables from Unvalidated or Validated EDD Macro to assist the PM with a validated data analysis. A separate table must be created for each matrix.

Data archiving forms will be generated and affixed to each Data Validation Report received, for cataloguing, tracking, and archiving purposes.

4.4.4 Chemist PreLoad Check

All data must be submitted to the PC for a Chemist PreLoad check prior to data loading. All EDDs will be compiled into a single excel Archive file. If data were not validated, the hardcopy data, Archive or PreLoad EDDs, QC association table, and Unvalidated Raw and Detects tables will be provided to the PC for a PreLoad Check that will ensure the hard copy data and EDDs are complete and acceptable. If data were validated, the hardcopy data validation report, validated EDDs, QC association table and Validated Raw

and Detects tables will be provided to the PC for a PreLoad Check that will ensure the hard copy data and EDDs are complete and acceptable.

4.5 Project Data Loading and Storage

All fully evaluated data will be stored in the project repository database(s). This includes other field data acquired with the tools described in the previous sections.

4.5.1 Data Loading

EDDs will be formatted into Load and Archive files with or without the use of the ALPTool, as specified on the EDD Prep for Load and Archive Files Checklist. The Load EDD and FDETool will then be provided to the Database Specialist, who will load the data into the project repository database(s).

4.5.2 Quality Assurance/Quality Control (QA/QC)

Following data loading, the Database Specialist will generate Post Load reports and provide them to the EIS for review and QC. The EIS will review these reports to verify that all data was loaded into the project repository database(s)correctly. Updates or corrections to loaded data will be coordinated with the Database Specialist as necessary. Any changes made to the data by the Database Specialist prior to load, or that will be completed after the load should be tracked, and incorporated into the hard copy and EDD files that are to be archived after project completion.

4.5.3 Invoice Review

Laboratory invoices should be submitted once the laboratory has completed requested analyses, and submitted all results and requested corrections. Data validation invoices should be submitted shortly after the validation has been completed, and the report submitted to CH2M HILL. Invoices will be submitted to the PM through AP Workflow for approval. After all data has been loaded into the data repository and corrections made, the PM should submit all laboratory and data validator invoices to the EIS for review and approval. The EIS will compare costs billed to CH2M HILL to the STS, project instructions, and EDD to ensure that the company is billed correctly for the sample, analysis, and cost totals.

4.5.4 Storage of Deliverables and Documentation

After all corrections identified through the data management process have been completed (if any), the final report written, and the project determined complete, the PM can grant approval to archive the EDD and hard copy data.

Electronic files should be provided to the DMC for archiving on the project servers. The hardcopy reports for any data that was not validated should be sent to the Data Archiving Specialist. For validated data, efforts will be coordinated with the Data Validator to ensure that both the hardcopy Data Validation Report and Laboratory Report are sent to the Data Archiving Specialist. The data will be prepped for archiving and filed within the building until the Data Archiving Specialist has received authorization to send the data to storage.

All project-related documentation generated, such as the STS, Corrections to File Letters, Login Reports, COCs, etc, should be filed into the appropriate project binder for future reference.

4.6 Reporting and Delivery of Results

EnStat will be the primary tool for project staff to access project data. EnStat provides options for querying different types of data and reports, including: raw tables, detects tables, Exceedance tables, regulatory criteria, etc. Adhoc queries or special requests will need to be coordinated with the Database Specialist.

Data requests should be coordinated with the project EIS. The PM will specify the data needs, requirements and formatting (i.e. headers, footers, or other special needs) to be applied to their requests. Raw, detects, and exceedance tables must be queried with EnStat and formatted separately with the Raw, Detects, & Exceedance Tables from EnStat Output Macro for EACH matrix (solid/aqueous). Other macro templates that can be utilized to assist with the formatting of EnStat output files include the HHRA Tables from EnStat Output Macro and EcoRisk Tables from EnStat Output Macro.

Data Management Checklist

base 1	Name:	CIO Number(s):
Site:		PM:
Samp	ole Date Range:	EIS:
Lab:_		DV:
SDG	#'s:	
		roject instructions, assign sample nomenclature, go over the EIS th PM). Determine EDD format to be used.
	be delivered to the lab (pick up, over required turn around times. If reque	of sampling schedule, coordinate with the lab how samples will might, drop off) and how often, ensure lab is aware of the ested, order bottle ware and create sample labels. If requested, the order to ensure the proper amount and type of equipment
	Help resolve issues that arise in the f of the shipment dates and the number	I lab during field event: Communicate with field staff daily. Field (bottle ware shortage, equipment failure, etc). Inform the laber of coolers or samples being sent. Ensure samples were received in holding time, within designated temperature). Notify field ere problems with shipment.
	Sample Tracking:	
	 Create sample tracking sheet and 	d update it as samples are collected.
	 Receive COCs from field crew: Inform field crew and/or lab if 	Perform a 100% quality check of the chains of custody (COC). corrections need to be made.
	 Receive confirmation sheets from lab if their information needs to 	m lab. Verify they have the correct information. Coordinate with be corrected.
	copy to the laboratory, data vali	etter for any COC/field log book/login discrepancy. Provide a idator, Project Manager, and Project Notebook. (See files and Template_Corrections-to-File)
		lata management process. Ensure that labs and validators deliver DG) on time. Inform project manager if SDGs are late and remind e in place).
		get Tracking Form to track the number of hours spent on each task roject manager if you suspect you will go over budget.
Pre-V	Validation:	
	QC lab data (For Specifics see EIS Q	QC Checklist):
	, , ,	nd EDDs are complete and acceptable. Run a quality check on the o) columns to ensure basic quality.
	•	ysis results. Ensure that the hard copy data matches the EDD. If ject manager and ask the lab to send corrected data.
	Communication with Lab: If there is coordinate with the lab to receive the	s missing data from the EDD, contact the project manager and e missing data.
	Run Unvalidated Tables:	
	 Check with the PM to see if they needs on the table. (i.e. headers, 	would like preliminary raw and detects tables. If so, verify the footers, or other special needs).
	• Run either the "Razu & Detects To	ables from Unvalidated or Validated EDD xls" or "Raw & Detects

Tables from Unvalidated or Validated SNEDD.xls" (depending on EDD format used) macro to create

tables to assist the PM in their preliminary analysis of the data.

	 Create a separate table for EACH matrix and Site (solid/aqueous) ask the PM how they would like these tables run before you start. 				
	Hard Copy Management: Fill out the Data Archiving Form for the lab data located at the following link and file on the top of each SDG. (\\ariadne\Proj\CLEANII\DataMgmt\EIS\Ref Manual Updating\Data_Mgmt_Manual-Spring-2007)				
	• The QC association table should be created using the COCs, field notes, and field crew to ensure accuracy. For further instructions on the QC table please go to the link above and select "Template_QC-Association_Table".				
	• If data are being validated, mail/email the hard copy data, EDDs, and QC association table to the validator. A Form I summary report should also be provided.				
	• If data are NOT being validated, provide the hardcopy data, EDDs, QC association table, and Unvalidated Raw and Detects tables to the Chemist for an Internal or PreLoad Check (see Chemist Preload Check section below).				
	Communication with Validator: Let the validator know ahead of time when to expect data. Inform validator of any samples or analyses that should not be validated. (For example grain size should not be validated)				
Field D	Pata Entry Tool:				
	Data Request/Needs Form: Following sample collection, complete the Data Request/Needs Form and email it to Bhavana Reddy/WDC and copy Mike Zamboni/WDC to request the Field Data Entry Tool (FDETool).				
	FDETool Data Entry: Enter data into the FDETool using field log books and COCs. Be as specific as possible with the information entered (check with the project manager and/or Field Team Leaders if you are unsure of information.)				
	Request Northing and Easting information from project manager if not provided. This data must be entered into the FDETool. (See file DMP_Survey-Coordinates-Workflow)				
	QC FDET Data: Complete FDET output reports and QC. Send to another EIS or project manager to review accuracy.				
	NIRIS Field NEDD Output: Output the necessary NIRIS field-related NEDDs from the FDETool if data is to be loaded into NIRIS (all projects with a SNEDD). Reserve these for after the data has been loaded into EnDat and the data is ready for archiving.				
Post-Va	alidation:				
	QC validated data (For Specifics see EIS QC Checklist):				
	Verify that the validated hard copy data and EDDs are complete and acceptable				
	• In the CH2M HILL EDD format, Data validators should have added qualifiers to the DV_QUAL and DV_QUAL_CODE fields and no other fields. In the SNEDD format, data validators should have updated the fields: Analyte_Value, Validator_Qualifier, QC_Narrative, Validator_Name, and Val_Date.				
	Check all validation-related Valid Values against Valid Value Look up Tables.				
	 Perform a 100% check of the DV_QUAL and DV_QUAL_CODE field (or Validator_Qualifier, QC_Narrative fields in the SNEDD). Ensure that the hard copy values match the EDD 				
	• Ensure that every record that needs a data validator qualifier has one (i.e. if the Lab_Qual field has a U qualifier then there MUST be a qualifier in the DV_QUAL or QC_Narrative field)				
	Run Validated Tables:				
	• Run validated raw and detects tables. Verify any specific needs on the table with the PM. (i.e.				

headers, footers, or other special needs).

- Run either the "Raw & Detects Tables from Unvalidated or Validated EDD.xls" or "Raw & Detects Tables from Unvalidated or Validated SNEDD.xls" (depending on EDD format used) macro to create tables to assist the PM and Chemist in their analysis of the data.
- Review tables to determine which analytes are classified under more than one analysis group. Resolve discrepancies with Project Chemist. Or, run a Pivot Table to determine if analytes are assigned to more than one analysis group. Follow the "Instructions_Analyte-Pivot-.doc" file to determine which analytes are classified under more than one analysis group. Use the "Form_Preferred-Analysis-Group.xls" file as a reference to assign the UNREJECTED result to the correct analysis group for these analytes.
- **PM Review of Data:** Provide the tables to the PM. Also ask the PM if they would like a copy of the Sample Tracking Sheet or Project Instructions to assist them in their review.

Archive/PreLoad EDD Prep:

CH2M HILL Format EDDs

- Compile the validated SDG EDDs into one Excel Archive file. In the CH2M HILL EDD format, add in additional columns CTO#, Prep_Method, and Validated. (This file will be archived) Save the Excel load file under a new name with the project or event and the date sampling began (i.e. "PAX_244_GW_Sampling_ARCHIVE_103103.xls"). Be as specific as possible when saving the file.
- For Sample_IDs with DL, RA, or RE appended (this indicates a second run on the same sample and therefore two or more sets of results), the data validator should have selected one result to be used and placed an "R" for rejected on the result(s) not to be used. Check that there is only one usable result for each analyte.
- Remove the DL-, RA-, or RE-type suffixes from all Sample_IDs. Verify that these designations are captured in the "ReRun" column before deletion.
- Conduct one quick final check for anomalies by setting filters for each column.

SNEDD Format EDDs

Compile the validated SDG EDDs into one Excel file. Save the Excel file under a new name, with
the project or event and the date sampling began (i.e.
"PAX_244_GW_Sampling_Validated_PreLoad_SNEDD.xls")

Chemist PreLoad Check:

Project Chemist QC of data

- If data are NOT being validated, provide the hardcopy data, Archive or PreLoad EDDs, QC association table, and Unvalidated Raw and Detects tables to the Chemist for an Internal or PreLoad Check. Verify that the hard copy data and EDDs are complete and acceptable.
- If data have been validated, provide the hardcopy data validation report, validated EDDs, QC association table, and Validated Raw and Detects tables to the Chemist for an Internal or PreLoad Check. Verify that the validated hard copy data and EDDs are complete and acceptable.

Load Preparation:

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CH2M HILL Format EDDs

- Conduct one quick final check of the Updated/QC'd ARCHIVE EDD provided by the Chemist for anomalies by setting filters for each column.
- **Delete Surrogate Records.** Delete ALL records that have a value in the "Result_Type" column.
- **Delete Lab QC Records.** Delete ALL records that have a value in the "Lab_QC_Type" column.
- Save the EDD with the deleted records as the Load EDD. i.e. "PAX_244_GW_Sampling_LOAD_103103.xls")

- Conduct one quick final check of the Updated/QC'd PreLoad EDD provided by the Chemist for anomalies by setting filters for each column. Import the file into the Archive and Load Prep Tool (ALPTool).
 Run the following functions: Prepare ALPTool, Import SNEDD, Check Analyte IDs, Archive EDD, Load EDD, NEDD. Save the outputted EnDat Archive, EnDat Load, and NIRIS NEDD files.
 Email Data Load: Send the CH2M HILL Excel LOAD file (the version WITHOUT the surrogate and QC data) and FDETool in an email to Bhavana Reddy and copy Mike Zamboni/WDC for loading into EnDat. In the email attach an electronic copy of the completed Data Request/Needs Form with the following information completed:

 Program Name (ex: Clean II)
 - Activity (ex: Little Creek)
 - CTO
 - Prime Contractor (company responsible for providing a product to the Navy)
 - Field Contractor (company who performed the field work)
 - Was the data upload scheduled with the DB staff?
 - Is the data validated?
 - Data Validator Name (If no DV then who within CH2M HILL evaluated the data?)
 - Number of samples
 - Dates of the sampling event
 - Number of records in EDD
 - Requested Due Date
 - Any Reports Requested?

Post Load: П QC Post Load Reports: Receive the post load reports from Bhavana Reddy or Mike Zamboni. QC reports and also send the reports to the project managers to review. Inform project managers of any corrections that need to be made. Coordinate these changes with Bhavana or Mike. EDD Archiving: Incorporate any corrections made by Bhavana or Mike during loading, or resolved П after loading into the CH2M HILL ARCHIVE EDD, SNEDD, and NIRIS NEDD. Send both files, along with the FDETool NIRIS field-related NEDD files to Chelsea Bennet/VBO for archiving. **Run Tables:** Meet with the PM to verify the needs on the tables (i.e. headers, footers, or other special needs). A raw and detects table must be created for EACH matrix and site (solid/aqueous). Ask the PM how they would like these tables run before you start. Pull the data from EnStat Run the "Raw, Detects & Exceedance Tables from EnStat.xls" Review Laboratory and Validator Invoices: Track invoices and approval dates on the tracking sheet Complete EIS Budget Form: Meet with project manager and the data management coordinator to discuss lessons learned. File Project Paperwork: File all documentation generated during the project (STS, Corrections to file, COCs, Lab Logins, etc) into the appropriate project binder for future reference.

EDD Prep for Load and Archive Files

CH2M HILL EDDs

- 1. Combine EDDs into one EDD. Two versions of the EDD will be generated (I. Archive, and II. Load)
- 2. ADD 3 Columns to the end of the EDD:
 - a. CTO (List the numerical value, or full TO number. Ex. CTO-177 = 0177, TO-45 = TO-45)
 - b. <u>Lab</u> (Write out the complete name)
 - c. <u>Validated</u> (T or F)
- 3. Rename the field Preparation as "<u>CH2M_Code</u>". Filter on each Analysis Group, and update this field according to the correct Valid Values for CH2M_Code. Ex. NONS for SVOA, NONE for METAL.
- 4. Highlight and Copy the Analysis_Method field, and insert the column before the field CH2M_Code. Rename the new field as <u>Preparation</u>.
- 5. Generate Archive EDD Save the file as the Archive EDD, with a descriptive file name explaining the data contained therein. Ex file name = CP_CTO-74_Site-30_SD_May-07_ARCHIVE_EDD
- 6. Generate Load EDD
 - a. Remove Lab QC data from the EDD Filter for non-blanks on the field Result_Type, and delete listed records. Filter for non-blanks on the field Lab_QC_Type, and delete listed records.
 - b. Review the field Sample_ID and ensure that all Lab QC Samples have been removed.
 - c. Save the file as the Load EDD. Ex. File name = CP_CTO-74_Site-30_SD_May-07_LOAD_EDD

SNEDDs

- 7. Combine SNEDDs into one SNEDD. Three file versions will be generated (I. Archive EDD, II. Load EDD, and III. NIRIS NEDD)
- 8. Open the ALPTool, and follow the directions and buttons listed in steps 1 through 4
 - a. Step 1 a) Click on the button 'Prepare ALPTool'. b) Click on the folder button, selected the SNEDD file to be imported from the appropriate director, and click on the button 'Import SNEDD'
 - i. If File will not import, clean the SNEDD file: Save the SNEDD as a tab delimited text file. Open a new excel workbook. Go to Data/Import External Data/Import data, and follow the wizard to import the text file into excel. When selecting the fields to import, be sure to specify the formatting type for each as Text. Save the new file, and return to step 1a.
 - b. Step 2 Click on the button 'Check Analyte IDs'. If any records are listed in the pop up, resolve any incorrect analyte IDs.
 - c. Step 3 a) Click on the button 'Archive EDD'. Follow the directions in the pop up to save the file. B) Click on the button 'Load EDD'. Follow the directions in the pop up to save the file.
 - d. Step 4 Click the button 'NEDD'. Follow the directions in the pop up to save the file. Click the button 'Close' to close the entire application.

9. Save Files

- a. Save the Archive EDD. Ex file name = CP_CTO-74_Site-30_SD_May-07_ARCHIVE_EDD
- b. Save the Load EDD. Ex file name = CP_CTO-74_Site-30_SD_May-07_LOAD_EDD
- c. Save the NIRIS EDD. Ex file name = CP_CTO-74_Site-30_SD_May-07_NIRIS_NEDD

EIS QC Checklist for Unvalidated and Validated EDDs/SNEDDs and Hard Copy Data

Sample Track	ting Sheet/Lab Login Reports					
\square Compare COCs and STS to the Project Instruction tables to verify that the COCs and Lab Logins reflect all						
requested analyses. Check with PM/Lab if there are any discrepancies.						
Havalidatad l	EDDs and Hard Conv. Data					
	EDDs and Hard Copy Data he analyses reported in the EDD to the STS to your that the lab has reported all requested analyses					
-	\square Compare the analyses reported in the EDD to the STS to very that the lab has reported all requested analyses for each sample. Resolve any discrepancies with the PM/Lab/Chemist.					
_						
☐ Verify colu	mns on the SNEDD/EDD match the CH2M HILL format specified; (Header spellings, order)					
☐ Check EDI	D/SNEDD Columns for correct Valid Values					
	Sample IDs match the STS exactly					
	Analysis Groups are correct (ex. Perchlorate can be WCHEM or EXPLO)					
	Dates/Times are numerical and progress appropriately (ex. Date analyzed after date sampled)					
	Chem Names and Analyte ID (CAS #)					
	Ana Values (SNEDD Original Analyte Value) match appropriate Reporting Limits (Metals					
	match MDL, all else match DL)					
	Analyte Values are appended to each Parameter. (Filter for blanks)					
	Units are correct for media (solid vs. aqueous)					
	Result Type, Lab QC Type, Rerun and Lab Code					
	Lab Code and/or Lab Name					
	onal SNEDD Valid Values Contract ID, DO CTO Number, and Installation ID are sourcest.					
	Contract ID, DO CTO Number, and Installation ID are correct					
	CH2M_Code					
	Sample Basis					
	Sample Medium					
	GC Column Type					
	Analysis Result Type					
	QC Control Limit Code					
	ard Copy Check. Perform a 10% - 20% QC on each analysis group to verify that the EDD and hard					
	cact match. Verify results for reextraction/reanalyses are reported in Hardcopy and EDD. Resolve cies with the Lab/Chemist.					
arry discrepair	cies with the Lab/ Chemist.					
Validated ED	<u>Ds and Hard Copy Data</u>					
☐ Validated l	EDD columns DV_Qual & DV_Qual_Code contain correct values					
☐ For SNEDI	O format, Analyte_Values are correctly copied/updated from Original_Analyte_Value. Columns					
	alifier, Validator_Name, and QC_Narrative are populated correctly					
	alidated marked up Form Is. Perform a 100% QC of all validated data in EDD and hard copy Form					
	list of discrepancies and request clarification from validator. Review data validation case					
_	nelp clarify possible mistakes.					
□ Eil	ter on non-detects (U, UJ, UL) in the Lab_Qualifier column and verify that the validator has copied					
	letects into the DV_Qual (or Validator Qualifier) column.					
☐ Generate validated Raw and Detects tables from the Validated EDD. Provide validated tables and EDD to Chemist for PreLoad Check.						